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Deep Hole Drilling

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DEEP HOLE drilling has always been somewhat of a nuisance in the shop. Often an appreciable percentage of the work is spoiled, the main cause being lack of straightness of the hole. This is a particularly troublesome condition when the outside diameter of the piece is not large as compared to the size of the hole. Almost anybody who has had to drill such deep holes is familiar with the fact that the drill sometimes comes out through the side of the piece. What happens oftener is that not enough material remains on one side of the hole to permit the piece to be turned to size, or that the hole is so crooked that it is not possible to ream it to the desired dimension.

Two methods of drilling deep holes are in general use. The most common one is to hold the piece of work stationary and revolve the drill. A better method, also in common use, is to hold the drill stationary and revolve the work, as in drilling of gun barrels.

There is nothing to guide the drill when the first named method is used. The drill is long and therefore flexible. It is held in the spindle of the machine by a relatively short taper, and, whether the spindle itself feeds out, or whether the entire spindle head feeds toward the work, the direction of the whole depends entirely on the stiffness of the drill. A jig bushing does not help, for as soon as the drill has penetrated to a considerable depth the bushing is too far away from the drill point to have any effect.

Though the two lips of a twist drill are supposed to take equal cuts, it is a well-known fact that there is generally a decided amount of difference between the two chips made by the two lips. As a result, there is more pressure against one side of the drill than against the other, which tends to make it deviate from the straight line. There is nothing to force the drill back to the proper direction. Besides, the relative shortness of the taper and a possible lack of straightness of the drill itself may make the original direction of the drill faulty. There is only one way to make sure that the hole shall be reasonably straight, and this is to feed very slowly, or, in other words, to have very little feed pressure.

The second method is decidedly better. The fact that the piece rotates causes the drill to have a tendency to follow the axis of rotation of the piece of work.

Describing the two common methods of drilling deep holes — tool revolving, and work revolving—and explaining the difficulties met and why they are overcome by a third method in which both tool and work revolve

However, there are some disturbing factors. The metal of the piece to be drilled is usually not homogeneous, which causes the drill to deflect. There is nothing to cause it to reassume its old direction. This deflection may be small, in which case it can be corrected by boring, or it may be so large that the drill comes out through the side of the piece.

Until now it has been assumed that a twist drill is used. The well-known gun barrel drill avoids the troubles caused by the uneven cut of the lips of a twist drill but is still subject to the deflection caused by the lack of homogeneity of the material of the work. Here, too, it is necessary to use a very light feed.

Deep hole drilling with rotating work can be done on the lathe or on machines specially built for this purpose. The drill press lends itself but poorly for such work, though once in a while it is possible to use it this way. Machines built on the plan of the drill press have the advantage over horizontal machines by the ease with which the chips are discharged. On the other hand, they have the disadvantage of being limited as to the length of work which they can handle with some ease. Generally speaking such machines must have a total height of at least two and one half times the depth of hole to be drilled.

Whether the horizontal or the vertical type of machine is used there is no assurance that the holes will be correct. A hole, to be correct, must fulfill the following requirements: the cross section must be a true circle, all cross sections must be of the same diameter, the axis of the hole must be a straight line, this axis must be in the proper direction in regard to the other elements of the work. and the diameter of the cross section must be the required one.

Not all of these requirements are of the same importance. In many cases boring or reaming operations follow the drilling, and sometimes both. In such cases there is no need for great accuracy as to the size of the drilled hole, nor for the close uniformity of the diameter. However, wide variations are not permissible. What is of the greatest importance is that the axis shall be a straight line or very nearly so, and that it shall be in the correct location and direction in relation to the other elements of the work. A very small deviation of the axis leads to errors which cannot be corrected by subsequent boring or reaming. Even when they can be corrected, it can be

done only at the expense of much time and trouble.

There is a third method which avoids the major troubles of the other systems of deep hole drilling and which is much more productive. This is the method of rotating both the drill and the work.

Such drilling can be done on the lathe if the carriage is provided with a fixture containing an individually driven spindle. There is no fixed ratio which must be maintained between the numbers of revolutions of the lathe spindle and the auxiliary spindle. The work may be heavy, and it may therefore be advisable to run it at a moderate speed, while the drill spindle may be run at any speed necessary to bring the cutting speed up to what it should be. As a rule, an attempt should be made to run the two spindles at speeds as nearly equal as possible.

The total power required for the operation is the same as if only one of the two spindles were doing all of the work, except, of course, that there is a slight additional friction load to overcome. The amounts of horsepower required for the two spindles are in proportion to their speeds. If, for example, 10 hp. were required and the lathe spindle were running at 80 r.p.m., while the drill spindle were running at 120 r.p.m., then two-fifths of the power would be required for the first and three-fifths for the second spindle; which is 4 and 6 hp. respectively. However, it should be kept in mind that the torque is the same for both spindles and again the same as if all the work were being done by one. The end thrust is also the same.

Coincidental Axes

The chief advantage of this method lies in the fact that the axis of the hole is the same as the axis of rotation of the work and is independent of the direction of the feed. This is not the case with the other two methods. To analyze what happens when conditions are not perfect, as is always the case more or less, we will assume that the drill or, more generally speaking, the tool is attached to its driving or feeding member by a short, stiff spring. Such a mode of attaching the tool would permit it to be fed or to be rotated or both, and yet allow it to assume any direction within fairly wide limits. In practice, the elasticity of the drill and some looseness in spindles and other parts does what the stiff spring is supposed to do here.

We can readily see what takes place when we use the drill press method, that is, revolve and feed the drill itself. As we have assumed that the driving spring is very short and stiff, we may consider that the drill has taken a direction in line with the axis of the drill spindle, and this is, practically speaking, in line with the direction of the feed. However, as soon as the drill has penetrated a little distance, its direction is subject to the conditions it meets. Lack of homogeneity of the metal or uneven cutting by the two lips may alter the original direction and a drill jig cannot do much good when the hole is a deep one.

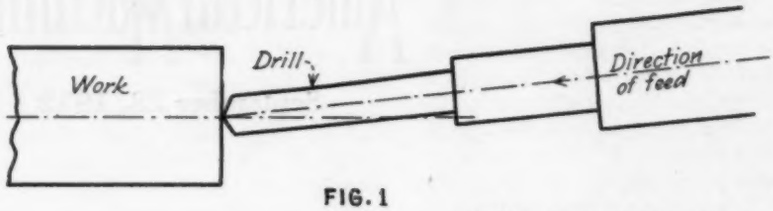


FIG. 1

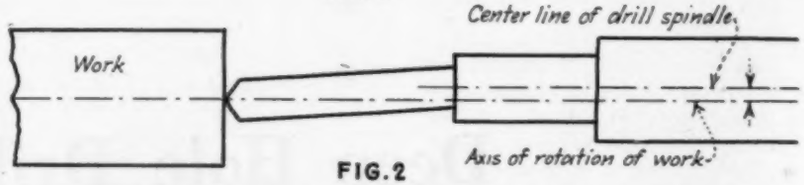


FIG. 2

Fig. 1—Diagram showing one reason why the deep hole drill sometimes comes out through the side of the work. Fig. 2—Diagram showing another reason why deep holes fail in accuracy

Theoretically speaking, the direction of the axis of the hole must coincide with the axis of rotation of the work when the second method is used, that is, when the work revolves and either the work or the drill feeds. In practice, this perfection is only reached when great care is taken to avoid disturbing factors. Assuming again that the drill is attached to its driving member by a short, stiff spring, we find that the axis of rotation of the work may not coincide with the direction of the feed. These two directions may be at an angle to each other or they may be parallel. We have a condition such as in Fig. 1 or 2. We will assume that in either case the drill point starts centrally. This can be made sure of by centering the work before starting the deep hole drill.

In the first case the direction of the feed itself causes the central line of the hole to be different from the axis of rotation of the work. In the second case the drill is slightly bent at the start and this causes it to proceed at an angle to the axis. The angles with which we have to deal are small, and if a short hole is to be drilled, they do not cause any practical difficulty, but when the hole is a deep one, the effect of having the drill at some slight angle to the direction of the axis of rotation becomes greater as the drill penetrates further.

Whether we are dealing with case one or case two, the drill is bent by the work and swung around. This may not be sufficient to break the tool, but it is certainly not helpful to a long life of the drill.

We find the same two cases when we use the third method, that is, the feed may be in the wrong direction, or it may be off center, but the results are not the same as in the previous cases. The drill acts as a boring tool. If we imagine that there is no preliminary centering of the work, and that the drill is $\frac{1}{16}$ in. off center when it starts, we can readily see that the point of the tool describes a circle with a radius of that amount around the center of the work and that the hole made by the tool must be $\frac{1}{8}$ in. larger than the tool itself. Similarly, if at any time during the progress of the tool there should be a condition which causes it to deviate to the right or left, this boring action will produce, at that point, a section of the hole with a somewhat larger diameter, but the direction of the axis of the hole has not been changed. Slag pockets, or blow holes, or soft spots in the metal do have a disturbing effect, but only in regard to the size, not as to the direction of the hole.

If the axis of the tool is at an angle to the axis of rotation of the work, the effect will merely be that one lip of the drill cuts in a slightly different position from the other. Neither size of hole nor direction is affected. However, if the direction of the feed is not the same as that of the axis of rotation of the work, there is an effect. As the drill proceeds, the hole becomes of larger and larger diameter. The tool makes a taper hole, and the side of this taper makes an angle with the axis of rotation of the work which is the same as that which the direction of feed makes with this axis.

If the tool starts at the precise center of the work, if the center lines of work and tool coincide, and if there is no disturbing element in the work itself, then the hole will be of the correct size and its center line will be the axis of rotation of the work. If the center lines are at an angle with each other, but the tool starts in the precise center, the resulting hole will be cone shaped and the small

diameter of the cone will be the diameter of the tool. If the two center lines are parallel, the resulting hole will be cylindrical but it will be larger than the tool by twice the distance between the two center lines.

If the two center lines make an angle with one another and the tool does not start at the precise center of the work, the resulting hole will be conical and the diameter at the small end will be that of the tool plus twice the distance between the tool point and the center of the work at the beginning of the operation.

There are several advantages in the use of this method of deep hole drilling. Whatever may be the condition of the metal to be drilled, of the alignment of the feed in relation to the work, or of the accuracy with which the operation is started, the resulting hole has always a straight axis and this axis is the same as the axis of rotation of the work. Defects of the metal may cause some section of the hole to be slightly larger than another but the amounts of these irregularities are always very small and easily corrected by subsequent boring or reaming. With reasonable care the amount of taper of the hole does not exceed a few thousandths of an inch and this, too, is readily reamed out. Such a thing as having the drill come out through the side of the work is out of the question, and if the drill point should be caught in a soft spot of the work, it enlarges the hole but causes no breakage.

Other Applications

Of course, this method of drilling does not need to be confined to deep holes, and there are cases when it can be used to good effect on short ones. The very fact that a taper hole is produced when the direction of the feed is not in line with the direction of the axis of rotation of the work leads to some interesting applications. In Fig. 3 a clevis is shown, such as is used for securing the end of a wire cable. As will be seen, the hole cannot be drilled starting at the large end, nor, if the small end is the starting end, can the hole be reamed taper. A rather complicated system of broaching is sometimes applied, but, in whatever way it is done, it is always a difficult operation. The system of drilling just described lends itself to this job by drilling from the small end and using a tool of the size of that end or a little smaller, and feeding in a direction parallel to the side of the taper. In this manner this complicated job becomes a very simple one; just drilling.

Another interesting application is illustrated in Fig. 4. A steel screw has to be secured to a brass knob. The illustration shows the piece much enlarged. A hole is drilled in the knob. The size of the drill is equal to, or a little less than, half the diameter of the screw, but the direction of the feed is at a considerable angle to the center line of the piece. As a result a taper hole is produced with a sharp pointed cone in the center. The screw is sawed in for a short distance, dividing it for that distance into four parts. When the screw is driven into the knob, the pointed cone spreads the four parts of the screw apart and secures it in the hole.

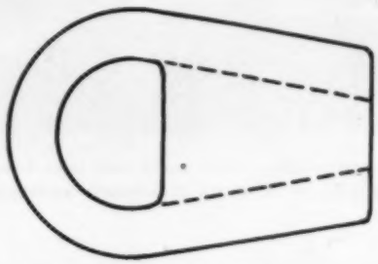


Fig. 3—Clevis bored by the method of rotating both work and tool, an otherwise very difficult operation

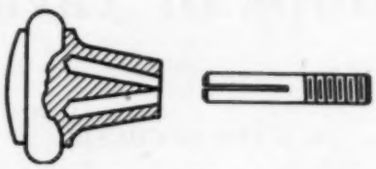


Fig. 4 — By revolving both work and tool the annular space surrounding the cone was easily produced, thus providing means of locking the split screw to the head

One of the problems connected with deep hole drilling is the disposition of the chips. This part of the problem is minimized, as we have seen, when a vertical machine is used and the drill is below the work. We have seen also that this method lends itself only to relatively short pieces. Long pieces must be drilled horizontally. The method universally in use for the removal of chips is to use a lubricant under high pressure, except in cases when the drilling of a deep hole is an odd job and when it would not pay to rig up a high pressure supply of lubricant. In such cases the operator withdraws the drill at frequent intervals, thus clearing hole of chips. Where deep hole drilling is a regular operation, such a method would be too slow and costly. It is evident that, if the chips are to find an outlet, the tool must not fill the hole. On the other hand, it is also evident that if a fair amount of feed, and therefore power, is to be used, the tool should be as strong as possible and consequently should fill the hole as nearly as is practical. A twist drill provides an outlet for the chips, but it is not practical to use such drills for holes five or ten feet in length, though this, too, may have been done at some time or other. Even so, when the twist drill is very long the chips will clog the flutes and are no longer ejected. We may say that some additional means is necessary for the removal of chips.

Applying Lubricant

There are three ways in which lubricant under pressure is applied. It may be led to the tool point through the center of the drill, in which case the chips are ejected on the outside of the tool; or it may be led along the tool, as is the case with the gun barrel drill. In that case, too, the chips find their way out along the outside of the tool. The third way is to admit the lubricant along the outside of the tool and eject the chips through the inside. This latter method can be used only with rather large holes, but is a very efficient method when it can be used. A short drill is used. It is attached to a hollow bar, which serves as driving member. This bar is of smaller diameter than the drill but the difference in diameter does not need to be large. The bar is fitted in a bushing and the bushing, in its turn, fits in the initial part of the hole. It is necessary, therefore, first to drill and bore a short part of the hole before the real deep hole drilling can begin. The lubricant is admitted through an opening in the bushing and flows around the driving bar to the tool point. The drill itself has an axial hole, which leads off with a gentle curve from the flutes. This passage and the flutes themselves should be nicely polished so as to offer a minimum of resistance to the flow of the chips. These chips must pass the entire length of the bar, which is somewhat more than the depth of the hole. Though this third method of deep hole drilling permits of using considerably heavier feed than the other methods, the feed per revolution is nevertheless small as compared to what could be used in ordinary drilling. The chips are thin and curl up and finally collect in the bar as a wad which stops the circulation of the lubricant. It is this very stoppage on which we depend for the ejection of the chips for, when the chips have formed themselves into this wad, the full pressure of the lubricating pump is built up and the wad is violently ejected.

The amount of pressure required depends on the length of the hole as well as on its diameter. Chips were properly ejected with a pressure of 300 lbs. per sq.in. when a 1¼-in. hole, 32 in. long, was drilled in this manner.

Apprenticeship starts early and lasts long with pay at three to five cents an hour

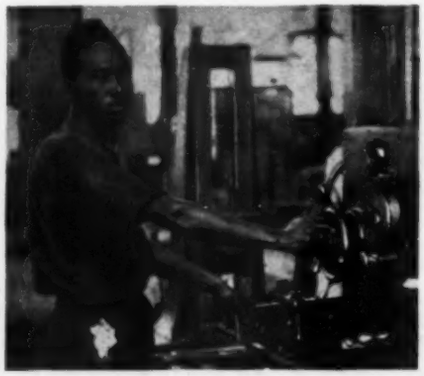
Shops of Java

WALTER BUCHLER

THERE are only a few really large shops in Java. These are located in Batavia, Bandoeng, Djocja, Semarang and Soerabaya. There are numerous other shops in the larger towns, but most of them are run by Chinese and do only repair work. The largest of the Javanese machine shops is run by a Dutch firm, called Braat, in Soerabaya. This shop makes every type of machinery required for sugar mills, tea factories and other native industries and is equipped with a steel furnace, the only one in the Dutch East Indies.

Naturally, almost all labor is Javanese. Chinese do carpentry work of the finer kind. Usually they receive their training in Shanghai, Hongkong or other Chinese coastal cities, and come to Java afterward. They work quickly and are clever copyists but are less original than American or European workman. The Chinese bow-drill and plane are their principal tools, their feet ever-efficient vises.

The Javanese begins his shop career as a small boy. His father or some relative who lives in the same Kampong (village) apprentices him to a shop owner. He will get three to five cents an hour (100 cents East Indies money = 40 cents gold) when he starts at the age of 11 or 12, but he does not have to do much. He simply stands near a lathe or other machine, from time to time bringing a tool or part to the operator. He may also be given some filing. Of recent years, technical schools have been opened by the government to train tradesmen. Those attending them for three years enter the shops as apprentices. At 25 years of age, they are made "half Tukans" or workmen capable of doing all-round work. But no matter how long they may have been in the shop or on any branch of machine work, they still require watching, especially in the manner they handle the tools given to them. For instance, if a Javanese has a bolt to loosen, instead of selecting the right tool, he will take the nearest at hand, and wrench it open. This is just sheer laziness.



Capable but lacking in originality is the Javanese workman

Javanese turners are capable men, but if one gives them a lathe with high production, only the first day will he get the maximum work out of it. Should supervision relax the next day the lathe hand will let the machine run at half speed, for he does not like to get things done too quickly. This naturally reduces production.

Many Javanese turners can cut threads by hand and do it absolutely accurately too. They prefer to work in this way, as they do not like to go to the trouble of adjusting the leadscrew of the lathe. The Javanese is mechanically inclined but does not have the technical experience to go with it. This makes it dangerous to allow him to put into practice his own ideas, which he is much inclined to do. In repairing engines, he knows exactly what to use to stop a leak. But he may use some such material as

In the tramway shops of Soerabaya, the acetylene torch finds a place

grease, which will stop it without a doubt but he does not realize the trouble that will afterwards result.

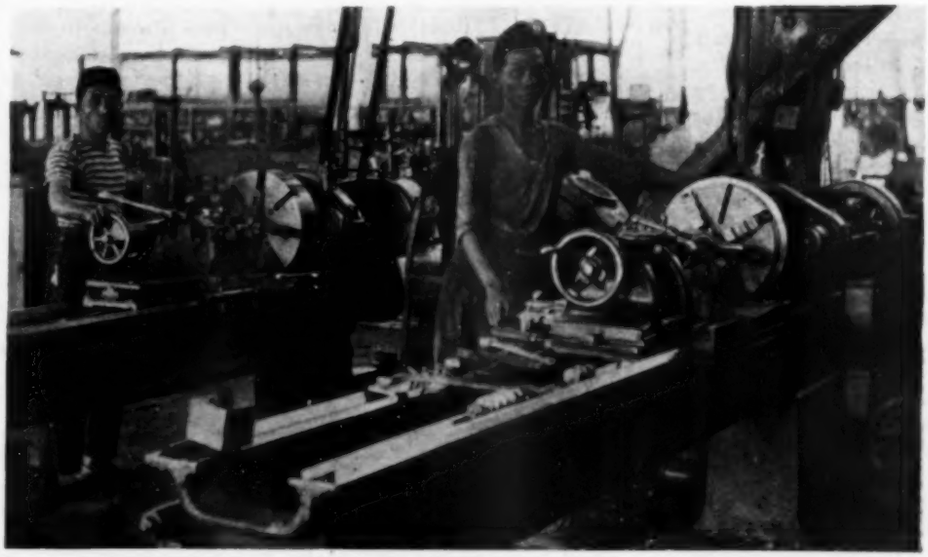
In the Kampongs, turners work with lathes of their own creation. These are rough, and they use them for any work given to them, such as motor car repairs, bicycles, and other small jobs. There are no large shops run by Javanese, as they are not a saving people, as are the Chinese, and have not yet reached the stage of employing more than two or three men at a time.

In the larger shops in Java, most of the machines in use in western countries are found, such as drilling, planing, grinding, shaping and other machines. Drills are spoiled there more quickly than elsewhere, for the Javanese at work is likely to let his attention drift and will take forty winks with the machine running.

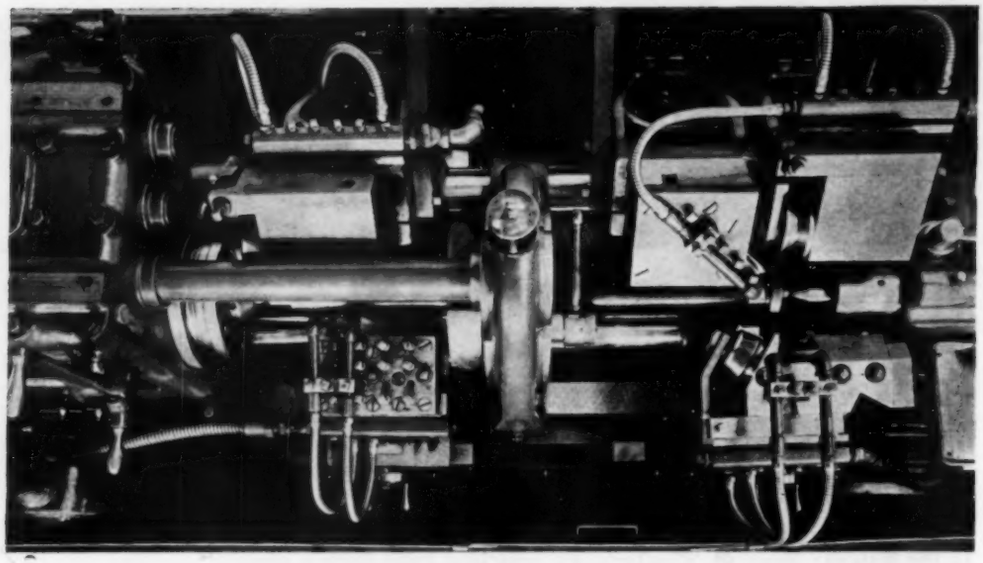
The Javanese coppersmith is an excellent man at his work, for this trade has been transmitted from father to son for generations, even before the Westerner came to the Dutch East Indies. In the Kampongs, he makes all sorts of household utensils and materials, while in the shops, his work is equal to that of the West; his soldering, bending and hammering are of the best. In the shops, the same materials as used in the West are used, but in the Kampong, he will use bellows of his own construction made of leather or bamboo, or he may simply use a fan over a wood fire.

Castings are made in the biggest shops, and even there the tendency of recent years has been, and continues to be, to buy all the castings required from abroad. This is cheaper than making them in Java. All such work is done by hand, as there is not enough of it to introduce machinery. The results are consequently not so good as the castings imported, the Javanese being inexperienced in this work and the material used being mostly scrap iron. Castings are rougher, and the composition of the metal is not as strong as that of those made abroad. Hence they are only made in Java when required quickly. The sand has to be imported, as that available locally will not stand the heat and melts too quickly. Patterns are made of Djatie wood (teak), which is cheap and plentiful in Java. This work is done by Chinese carpenters to designs drawn up by Europeans.

Javanese blacksmiths have not the strength or physique of the Westerner, so more heating of the material is required. As a rule three men work on a job (one blacksmith and two hammer men). Wages are much lower than those in the West, and fitters, turners, machine hands, blacksmiths and carpenters get, on an average, 20 cents (10 cents gold) an hour, whilst coppersmiths, molders and plateworkers, receive two or three cents more. Chinese carpenters are fairly highly paid, earning thirty to thirty-five cents an hour.



Mechanically inclined and skillful but with an aversion for speed



Two circular forming tools, one set at right angles to the work and one at an acute angle are used on this 12-in. Fay automatic

Contour Calculations for Forming Tools—V

Tools set or fed at an angle to the work are now analyzed in considerable detail

O. A. JOHNSON

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Tyson Roller Bearing Corporation

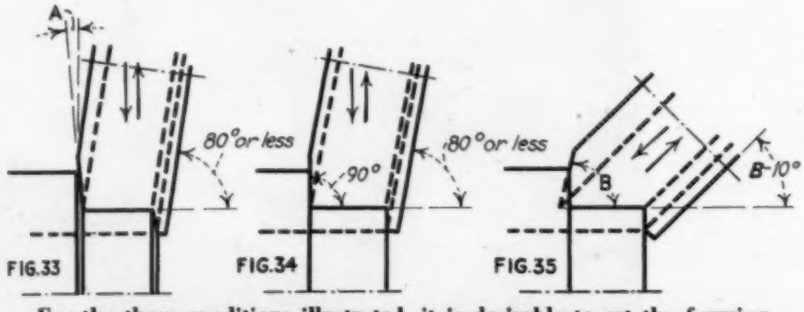
PREVIOUS articles explained the design of external and internal forming tools set at 90 deg. and also fed at 90 deg. to the product. On these tools, all dimensions parallel with the center line of the tool are also parallel with the center line of the product. These dimensions, therefore, are not distorted on the tool, as are the dimensions perpendicular to the center line, but remain the same as on the product.

For circular forming tools set at an angle less than 90 deg. to the center line of the product, the center line of the tool is not parallel to the center line of the product. Consequently, dimensions parallel with the center line of the tool are distorted as well as those perpendicular to it. This condition makes tool calculation even more complicated than for those set at a 90-deg. angle.

On many jobs, a circular forming tool set at an angle less than 90-deg. to the center line of the product will give excellent results. Sometimes this is the only solution which will give a free-cutting tool and a good finish on the product.

Figs. 33, 34 and 35 show different applications of tools working at an angle. The tool shown in Fig. 33 and 34 is set at an angle of less than 90 deg. and is fed at an angle of 90 deg. to the center line of the product. The tool shown in Fig. 35 is set at an angle of less than 90 deg. and is also fed at an angle of less than 90 deg. to the center line of the product. In Fig. 33, angle *A* is less than 10 deg. In Fig. 34, the product has a 90-deg. angle while in Fig. 35, the angle *B* is less than 90 deg. The tools shown in Fig. 33 and 34 should be set at an angle of not more than 80 deg. to the center line of the product. The setting angle and also the feed angle for the tool shown in Fig. 35 should not be more than *B* minus 10 deg.

Many machine tool manufacturers are using forming tools setting at 90 deg. to the center line of the product for the condition shown in Fig. 33 or even for that in Fig. 34. The result is that the tool does not have a great enough clear-



For the three conditions illustrated, it is desirable to set the forming tool at an angle to the work. For the work shown in Fig. 35 acute angle feed is also essential

ance angle for the product shown in Fig. 33 nor any at all for the product in Fig. 34 and consequently the tool will drag on the work and tear the surface. The tool will also heat up and fail to last nearly as long between grinds as when proper clearance is provided.

The cone for a tapered roller bearing, manufactured by the Tyson Roller Bearing Corporation, presents quite an unusual machining problem; yet it is machined comparatively easily by circular forming tools.

Fig. 36 shows the product before grinding. If machined from forgings on a single-spindle automatic machine, one circular finishing tool and one circular roughing tool are used. If machined from bar stock on a four-spindle machine one circular finishing tool and one compound first circular and second circular roughing tools are used. One end of the roughing tool leaves 0.008 in. all around the profile for the finishing tool to remove, and the other end breaks down for the next cone. The roughing tool is set at an angle of 80 deg. and is fed at an angle of 90 deg. to the center line of the product. The finishing tool is set and fed at 45 deg. to the center line of the product. This is clearly shown in Fig. 37.

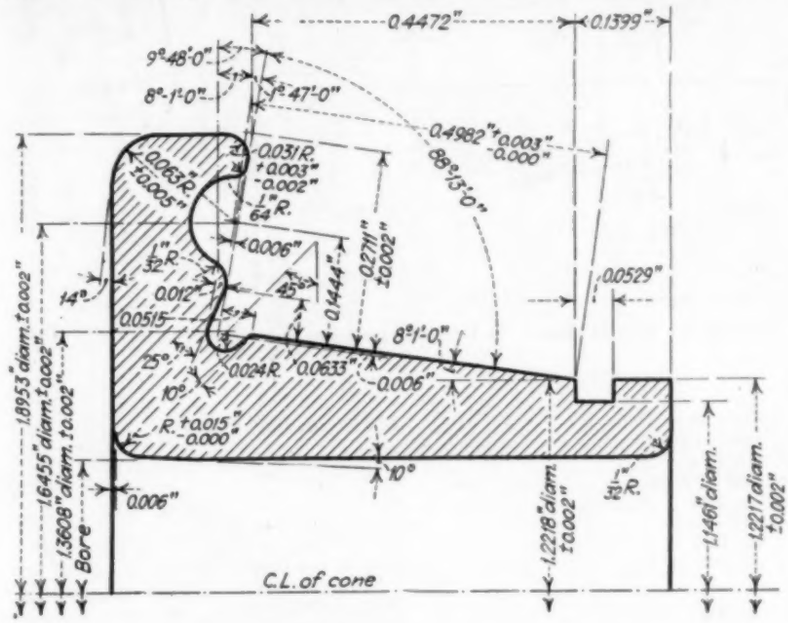
We will calculate this roughing tool point by point. I believe it is essential to go through the calculation of all the points in order to understand the procedure properly as we probably encounter all possible conditions in calculating these points.

Fig. 38 is the plan view of the tool in finished position, Fig. 39 is the end view of the tool in finished position, and Fig. 40 is the end view of the product showing the points of the tool in finished position. Fig. 41 is a layout of the tool profile.

We must remember that for these tools all calculations must be made in the true plane of the intersecting lines and circles. We will first calculate some of the necessary dimensions on Fig. 38. The rake angle on this tool will be ground parallel with the center line of the tool. Then Point 1 will be the only point to cut on center of the work; all other points will cut below center except Point 8 which will cut slightly above. This will be permissible because this point of the tool is cutting at the face of the work. If we draw a line from Point 1, parallel with the center line of the tool, we know that any point on this line will fall on the center line of the product. Then if we draw lines perpendicular to the center line of the product from each point, we will obtain Points P2′, P3′, P4′, P5′, P6′, P7′, and P8′, where these lines intersect line *A-A*. These new points are then located on the center line of the work in Fig. 40. The distorted rake angle is then calculated—the rake angle that we see if we look straight in at the end of the work with the tool in finished position. Lines are then drawn from these points (See Fig. 40) at the distorted rake angle, and where these lines intersect the true circles for the individual points, the true points are located.

The tool calculations follow:

Fig. 36—This roller bearing cone presents problem in machining best solved by the application of forming tools set at an acute angle



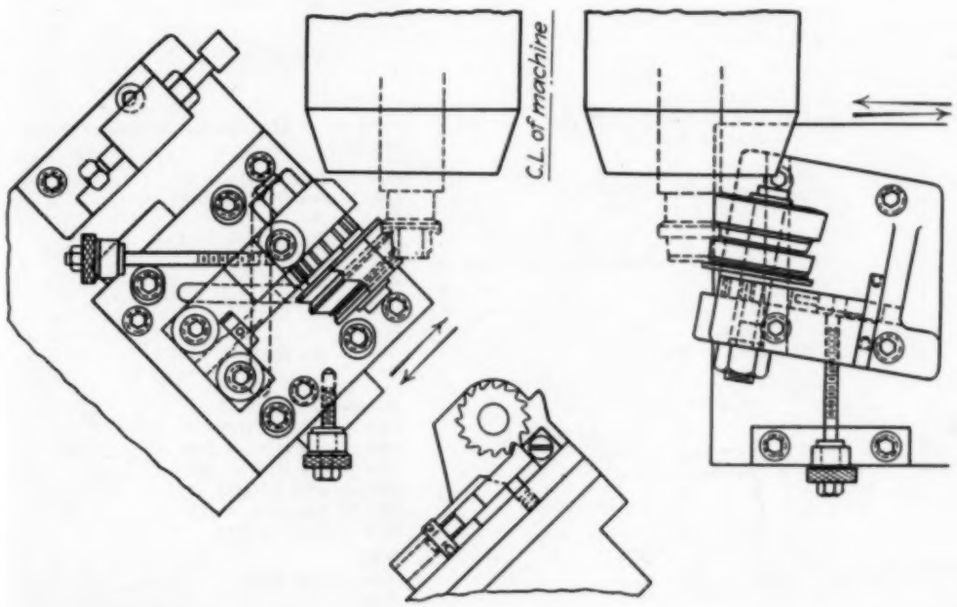


Fig. 37—First and second roughing tools are combined and set at an angle to the work. The finishing tool is set and fed at 45 deg.

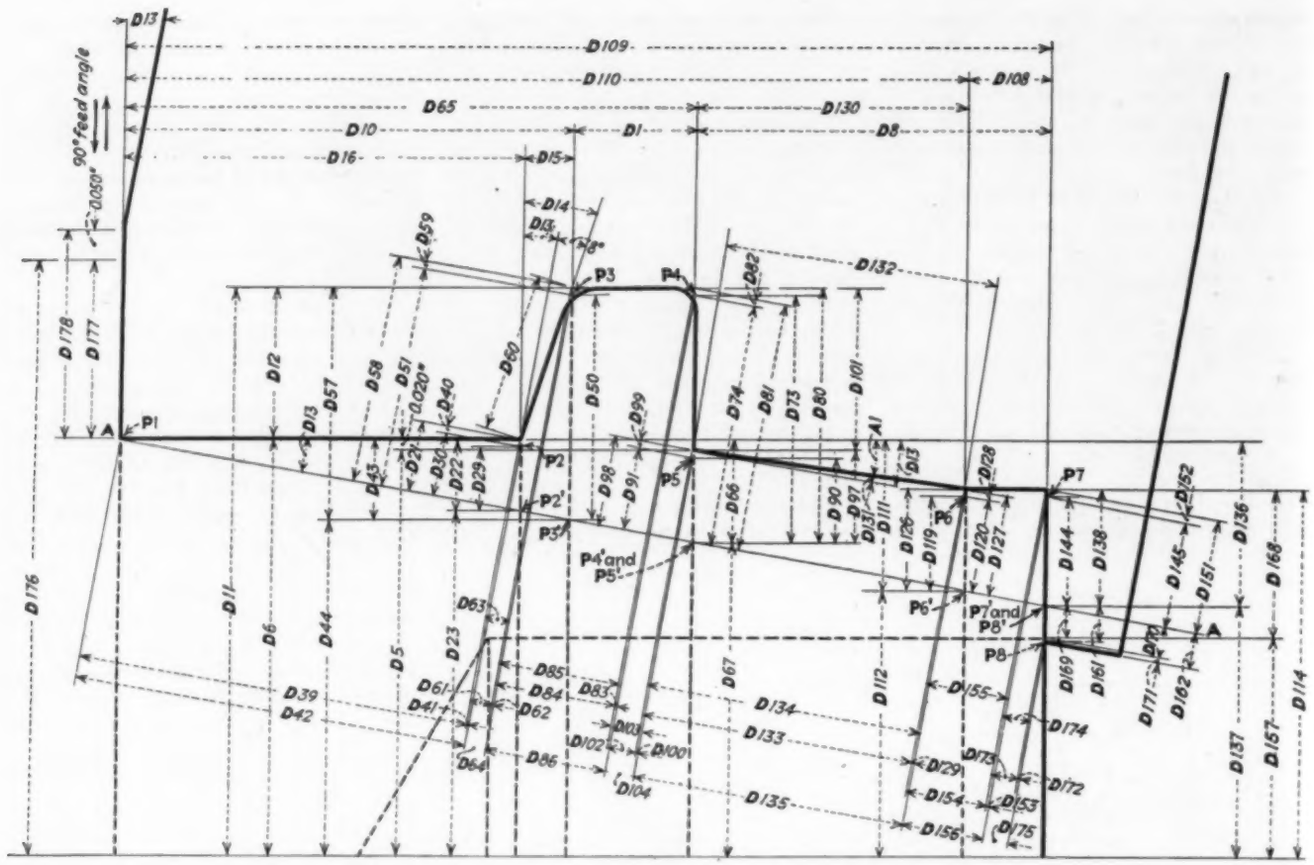


Fig. 38—A plan view of the tool is shown in finished position

$D5 + 0.020$ in. $= D6$
$D11 - D6 = D12$
$D13 = 90$ deg. — setting angle
$D13 + 8$ deg. $= D14$
$D12 \times \tan D14 = D15$
$D10 - D15 = D16$
$D17$ = clearance angle (about 10 deg. for steel)
$D18$ = rake angle (about 20 deg., variable for different kinds of steel)
$D17 + D18 = D19$

$$\frac{\tan D18}{\cos D13} = \tan D20 \text{ (distorted rake angle)}$$

$D16 \times \sin D13 = D21$
$D16 \times \tan D13 = D22$
$D6 - D22 = D23$
$D23 \times \cos D20 = D24$
$D23 \times \sin D20 = D25$

$$\frac{D25}{D6} = \sin D26$$

$D6 \times \cos D26 = D27$
$D27 - D24 = D28$
$D28 \times \cos D20 = D29$
$D29 \times \cos D13 = D30$
$D31$ = radius of tool at Point 1
$D31 \times \cos D17 = D32$
$D32 - D30 = D33$
$D31 \times \sin D17 = D34$
$D30 \times \tan D18 = D35$
$D35 + D34 = D36$

$$\frac{D36}{D33} = \tan D37$$

$$\frac{D33}{\cos D37} = D38 \text{ (radius of tool at Point 2)}$$

$D16 \times \cos D13 = D39$
$D21 - D30 = D40$
$D40 \times \tan D13 = D41$
$D41 + D39 = D42$
$D10 \times \tan D13 = D43$
$D6 - D43 = D44$
$D44 \times \cos D20 = D45$
$D44 \times \sin D20 = D46$

$$\frac{D46}{D11} = \sin D47$$

$D11 \times \cos D47 = D48$
$D48 - D45 = D49$
$D49 \times \cos D20 = D50$
$D50 \times \cos D13 = D51$
$D32 - D51 = D52$
$D51 \times \tan D18 = D53$
$D53 + D34 = D54$

$$\frac{D54}{D52} = \tan D55$$

$$\frac{D52}{\cos D55} = D56 \text{ (radius of tool at Point 3)}$$

$D11 - D44 = D57$
$D57 \times \cos D13 = D58$
$D58 - D51 = D59$

$$\frac{D12}{\cos D14} = D60$$

$D60 \times \sin 8$ deg. $= D61$
$D59 \times \tan D13 = D62$
$D62 + D61 = D63$
$D63 - D41 = D64$
$D1 + D10 = D65$
$D65 \times \tan D13 = D66$
$D6 - D66 = D67$
$D67 \times \cos D20 = D68$

$D67 \times \sin D20 = D69$

$$\frac{D69}{D11} = \sin D70$$

$D11 \times \cos D70 = D71$
$D71 - D68 = D72$
$D72 \times \cos D20 = D73$
$D73 \times \cos D13 = D74$
$D32 - D74 = D75$
$D74 \times \tan D18 = D76$
$D76 + D34 = D77$

$$\frac{D77}{D75} = \tan D78$$

$$\frac{D75}{\cos D78} = D79 \text{ (radius of tool at Point 4)}$$

$D11 - D67 = D80$
$D80 \times \cos D13 = D81$
$D81 - D74 = D82$
$D82 \times \tan D13 = D83$
$D1 \times \cos D13 = D84$
$D84 + D83 = D85$
$D85 - D62 = D86$

$$\frac{D69}{D5} = \sin D87$$

$D5 \times \cos D87 = D88$
$D88 - D68 = D89$
$D89 \times \cos D20 = D90$
$D90 \times \cos D13 = D91$
$D32 - D91 = D92$
$D91 \times \tan D18 = D93$
$D93 + D34 = D94$

$$\frac{D94}{D92} = \tan D95$$

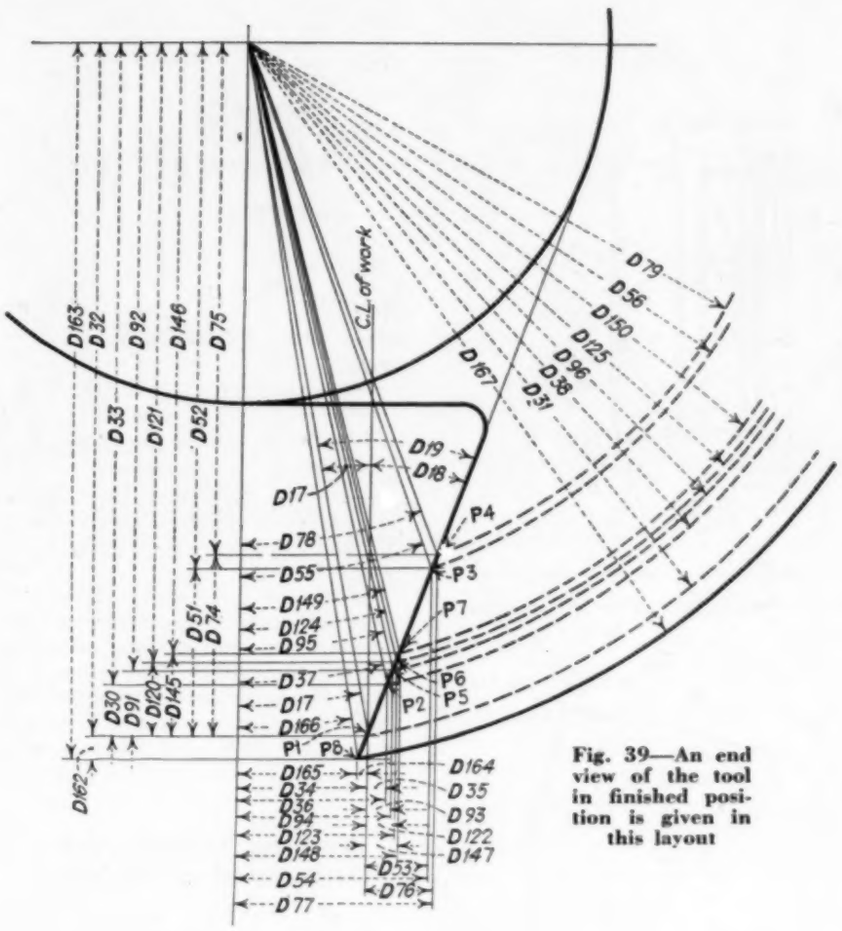


Fig. 39—An end view of the tool in finished position is given in this layout

$$D8 - D108 = D130$$
$$D13 - A1 = D131$$
$$\frac{D130}{\cos A1} = D132$$
$$D132 \times \cos D131 = D133$$
$$D133 + D129 = D134$$
$$D134 - D100 = D135$$
$$D109 \times \tan D13 = D136$$
$$D6 - D136 = D137$$
$$D114 - D137 = D138$$
$$D137 \times \cos D20 = D139$$
$$D137 \times \sin D20 = D140$$
$$\frac{D140}{D114} = \sin D141$$
$$D114 \times \cos D141 = D142$$
$$D142 - D139 = D143$$
$$D143 \times \cos D20 = D144$$
$$D144 \times \cos D13 = D145$$
$$D32 - D145 = D146$$
$$D145 \times \tan D18 = D147$$
$$D147 + D34 = D148$$
$$\frac{D148}{D146} = \tan D149$$
$$\frac{D146}{\cos D149} = D150 \text{ (radius of tool at Point 7)}$$
$$D138 \times \cos D13 = D151$$
$$D151 - D145 = D152$$

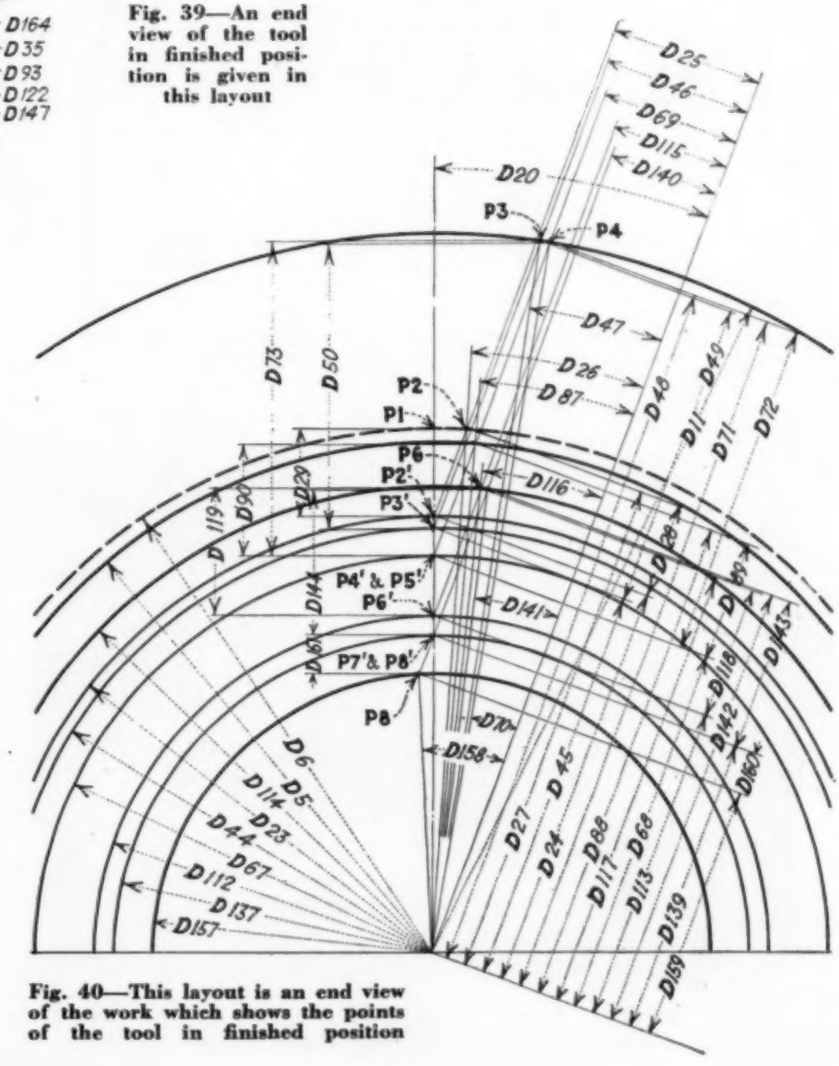


Fig. 40—This layout is an end view of the work which shows the points of the tool in finished position

$$\frac{D92}{\cos D95} = D96 \text{ (radius of tool at Point 5)}$$
$$D5 - D67 = D97$$
$$D97 \times \cos D13 = D98$$
$$D98 - D91 = D99$$
$$D99 \times \tan D13 = D100$$
$$D11 - D5 = D101$$
$$D101 \times \sin D13 = D102$$
$$D102 + D100 = D103$$
$$D103 - D83 = D104$$
$$D8 + D65 = D109$$
$$D109 - D108 = D110$$
$$D110 \times \tan D13 = D111$$
$$D6 - D111 = D112$$
$$D112 \times \cos D20 = D113$$
$$A132 + 0.008 \text{ in.} = B114$$
$$D112 \times \sin D20 = D115$$
$$\frac{D115}{D114} = \sin D116$$
$$D114 \times \cos D116 = D117$$
$$D117 - D113 = D118$$
$$D118 \times \cos D20 = D119$$
$$D119 \times \cos D13 = D120$$
$$D32 - D120 = D121$$
$$D120 \times \tan D18 = D122$$
$$D122 + D34 = D123$$
$$\frac{D123}{D121} = \tan D124$$
$$\frac{D121}{\cos D124} = D125 \text{ (radius of tool at Point 6)}$$
$$D114 - D112 = D126$$
$$D126 \times \cos D13 = D127$$
$$D127 - D120 = D128$$
$$D128 \times \tan D13 = D129$$

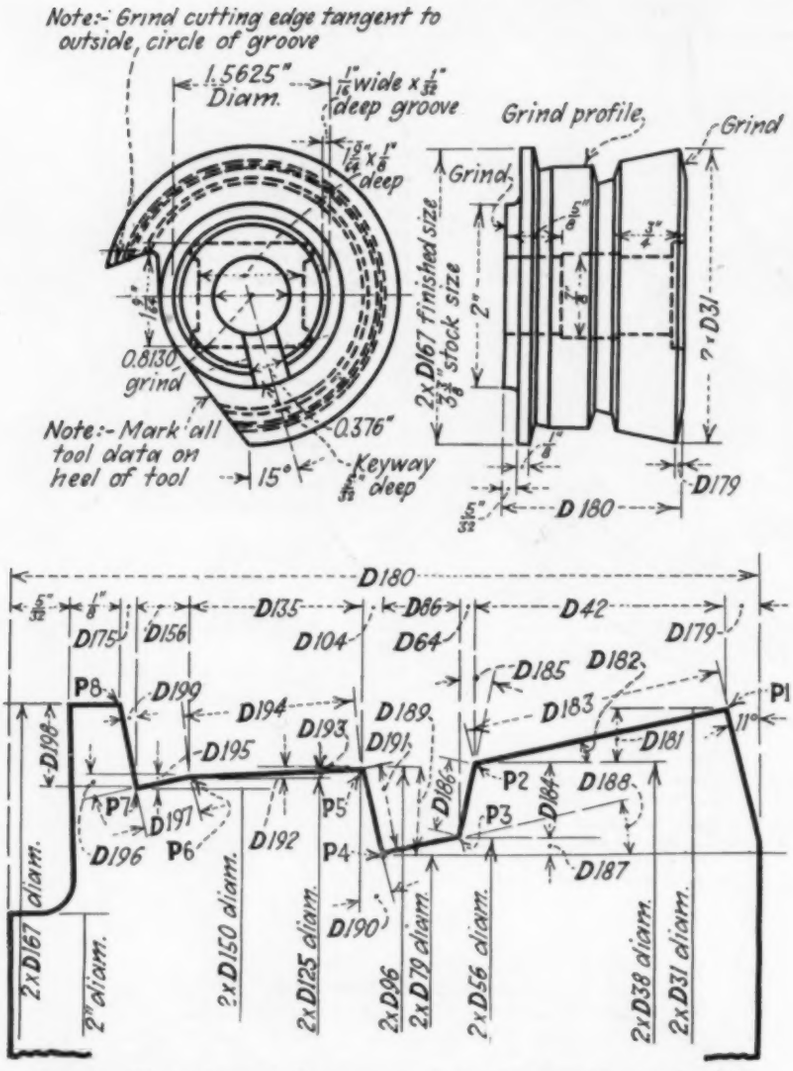


Fig. 41—Dimensions of the compound circular roughing tool profile may be calculated from the layouts illustrated

$D152 \times \tan D13 = D153$
$D108 \times \cos D13 = D154$
$D154 + D153 = D155$
$D155 - D129 = D156$

$$\frac{D140}{D157} = \sin D158$$

$D157 \times \cos D158 = D159$
$D139 - D159 = D160$
$D160 \times \cos D20 = D161$
$D161 \times \cos D13 = D162$
$D162 + D32 = D163$
$D162 \times \tan D18 = D164$
$D34 - D164 = D165$

$$\frac{D165}{D163} = \tan D166$$

$$\frac{D163}{\cos D166} = D167 \text{ (radius of tool at Point 8)}$$

$D114 - D157 = D168$
$D137 - D157 = D169$
$D169 \times \cos D13 = D170$
$D162 - D170 = D171$
$D171 \times \cos D13 = D172$
$D168 \times \sin D13 = D173$
$D173 + D172 = D174$
$D174 - D153 = D175$

$D176$ = half of stock diameter
$D176 - D6 = D177$
$D177 + 0.050$ in. $= D178$
$D178 \times \sin 11$ deg. $= D179$
$D179 + D42 + D64 + D86 + D104 + D135 + D156 + D175 + 0.28125$ in. $= D180$
$D31 - D38 = D181$

$$\frac{D181}{D42} = \tan D182$$

$$\frac{D42}{\cos D182} = D183$$

$D38 - D56 = D184$

$$\frac{D64}{D184} = \tan D185$$

$$\frac{D184}{\cos D185} = D186$$

$D56 - D79 = D187$

$$\frac{D187}{D86} = \tan D188$$

$D96 - D79 = D189$

$$\frac{D104}{D189} = \tan D190$$

$$\frac{D189}{\cos D190} = D191$$

$D96 - D125 = D192$

$$\frac{D192}{D135} = \tan D193$$

$$\frac{D135}{\cos D193} = D194$$

$D125 - D150 = D195$

$$\frac{D195}{D156} = \tan D196$$

$$\frac{D156}{\cos D196} = D197$$

$D167 - D150 = D198$

$$\frac{D175}{D198} = \tan D199$$

For the calculation of specific tool dimensions to the necessary degree of accuracy, logarithmic tables should be used. The application of these tables to similar calculations was given in a previous article (*AM*—Vol. 76, page 896).

Keeping Vertical Slides Lubricated—*Discussion*

FRANCIS W. SHAW
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In view of my experience in the same direction as that of Ernest C. Allen, as set forth by him in an article under the title given above (*AM*—Vol. 76, page 708), may I hazard the opinion that to apply a split ring, a retainer and a felt pad for the purpose of preventing oil from flowing down the slide and creating a messy condition is an unnecessary complication. A few felt pads, staggered so as to wipe the whole of the surface, will serve quite as well. If the pads are soaked in oil every month, they will quite suffice to maintain efficient lubrication. How to lubricate the upper end of the bearing of a vertical shaft, where the shaft rotates but does not slide, is a more difficult proposition; and it is still more difficult to prevent an undue flow of oil from the lower end of the bearing. Here again, where the speeds were not high, I have adopted the felt-pad construction with some measure of success, but have been compelled to run the pad right to the top of the bearing. Where this was not done it was impossible to get any oil to the top of the bearing, which rapidly became scored, as did the shaft, seizure finally taking place.

Personally, I should like to see a discussion on this, by no means simple question.

Some Thoughts on Tungsten Carbide
Discussion

FRANK W. CURTIS

Research Engineer,
Kearney & Trecker Corporation

In a previous article (*AM* — Vol. 76, page 674), F. L. Pyle listed a number of precautions he found necessary to observe when using tungsten carbide. The present author supplements this list

WITHOUT doubt, the majority of tungsten-carbide failures are caused by lack of knowledge as to correct methods of application. Knowing what is essential for success, then following the right procedure, is what counts. Guess-work will always cause trouble.

To the list of eleven suggestions offered by Mr. Pyle—all of which are basically important—there are a few more which fit right in line with what may be termed "Rules for Using Tungsten-Carbide." I realize that no attempt was made to cover the subject thoroughly, because a full-sized textbook would be required for that, but when reading the rules given by Mr. Pyle, I was prompted to add six more recommendations:

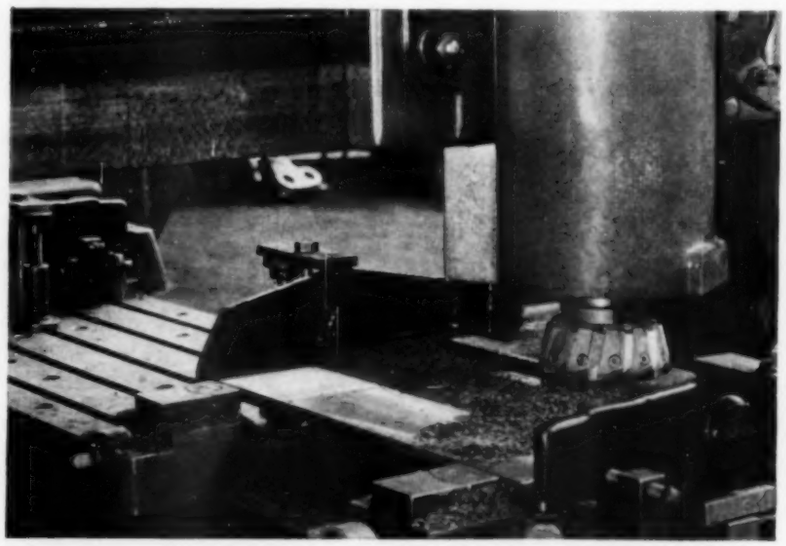
1. Do not stop tungsten-carbide tools in the cut.
2. Use a larger size tool whenever possible.
3. Stamp cutting angles on the body of the tool.
4. Start new jobs by increasing feeds and speeds gradually.
5. Keep performance records for reference.
6. Do not follow traditional practice.

When a tungsten-carbide tool is stopped in the cut, whether it is a milling cutter or a lathe tool, there is great danger for the tip or tips engaged in the cut to crack. Just as the final stop is made, a terrific pressure is exerted on the face of the tungsten-carbide insert because the tool is called upon to act as a brake to stop rotation. During the cut, there is enough momentum to rotate the work or cutter, as the case may be, so that the cutting pressure is lessened. Sometimes the tool is broken because of the "kick back" pressure which occurs after rotation has stopped. The danger here is that the cutting edge is subjected to a reverse strain which has a tendency to lift it away from the solid portion of the tool. Usually the braze is stronger than the carbide itself, with the result that these strains will fracture the carbide directly above the braze. To avoid this danger always disengage the feed first, then the rotation.

Because of the characteristics of tungsten carbide, it is necessary that rules be applied for its application differing from those for steel. One of the most important perhaps is that of using larger and heavier tools. The best known advantages of tungsten carbide are the increase in speed and a proportionately greater increase in feed. This means that the tool will have to do more work or remove more metal per minute. On this basis it is natural to assume that the tool should be much larger because of the additional work it is called upon to do.

One of the causes of failures of tungsten-carbide tools is that of grinding improper clearance angles on the tool. Often the tool will be applied correctly at first, and the results will be remarkable. However, as the tool is used and reground, the performance seems to dwindle. Frequently this is caused by improper grinding. The original angles have been disregarded, and the clearances have been gradually increased to a point where failure occurs. To avoid this, it is well to stamp clearance angles on all tools after they have been properly determined and then periodically to check these angles to make sure they are being maintained as tools are resharpened. The shank of a tungsten-carbide tool is usually soft so these clearance angles may be stamped without difficulty.

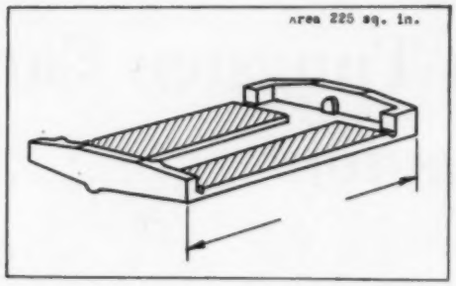
Many shopmen read of the outstanding performances being attained with tungsten-carbide tools and are likely to attempt to achieve similar results immediately without trial. This is a cause of many failures, because certain factors



Carbide cutters emphasize the need of reducing idle time between cuts. Here is a double set-up designed with this end in view

T. C. PERFORMANCE RECORD

Record of Job No: 133-8 Date: 5-22-32



Name: Motor Support Plate Part No: 16666 Brinell:

Material: Cast Iron Heat Treatment: None

Type of Machine: Bridge-type No: 906 Motor HP: 15 No: 174

Operation: Mill motor pads

Dept. No: 8 Operator's No: 815 Order No: 1647

Type and Size of Tool: 5-in. Full-Back Face Milling Cutter

Tool No: 82-M Condition: Sharp

T.C.		H.S.S. Rough	H.S.S. Finish	T.C.		H.S.S.
180	Rev. per min.	45	60	6" R.H.	Diam. of cutter	6" R.H.
283	Cutting speed	71	94	12	No. of teeth	12
5/32"	Depth of cut	1/4"	0.015"	1	No. of cuts	2
17"	Feed per min.	8.5"	10.5"	4	Cutting time	11.7—6
0.060"	Feed per rev.	0.122"	0.175	6.8	Floor-to-floor time	20.5
0.005"	Feed/tooth/rev.	0.010"	0.014"	*	Pcs. per grind	50 approx.
13.2	Cu.in. per min.	6.8	.52	13.7	Time saved	--
None	Coolant	None		67	% of cutting time	--

REMARKS: T-C has made it possible to reduce the depth of cut from 1/4" to 5/32", saving approximately 21 cu. in. of material per piece. *T-C cutting edges showed no signs of wear after completion of order (24 pieces). Much of the gain is made by combining the roughing and finishing cut into one. The finish obtained is equal to, or better than that obtained in two cuts. The reduction in feed per tooth per revolution not only aids the finish, but also improves the accuracy.

Approved: Signed:

Records of performance serve to analyze a particular job and to apply the experience thus gained to other work

have to be known first, such as the condition of the machine, the reliability of the fixture, and the general nature of the set-up. For this reason, it is always well to start a new job with conservative feeds and speeds and to increase these gradually by trial until the desired results have been obtained. Sometimes it is necessary to sacrifice maximum performance because of some weakness in the set-up, and where this prevails, it is much better to reach that point gradually from lower levels, rather than by starting with higher speeds and feeds with a possible immediate failure.

Keeping performance records is valuable in many ways. One of the greatest uses is in broadening the use of tungsten-carbide tools for other operations throughout the shop. By keeping such data as speeds, feeds, life between grinds, and other pertinent information, it is possible to refer to such data when handling similar operations. A record of this kind also comes in handy when comparing the performances of different types of carbides.

A tungsten-carbide performance record sheet is illustrated, showing the results of milling cast-iron motor support plates. This record gives a complete story of the previous and present methods of handling this operation; under "remarks" is included an interesting story of how a saving in material was made.

For this operation two fixtures are used, one at each end of the table, so that one piece can be loaded while the other is being machined. This reduces lost time to a minimum.

One of the greatest errors made in shops today in the application of tungsten-carbide tools is that of following traditional practice. It seems that the general tendency is to carry out the same ideas which have existed for years past. For example, if a certain operation had always been done with a $\frac{5}{8}$x $1\frac{1}{4}$-in. tool, it seems that the same size is applied even when tungsten carbide is considered.

Following traditional practice is all right to a certain extent, but there are cases where new originations are required. The entire set-up may not be rigid enough, and this alone means that many changes are required. First of all, the machine should be somewhat heavier, then the fixture should be more rugged in construction, and last, the tool or cutter should be of larger size and of correct design.

Tool design is undergoing many changes at this time on account of the introduction of carbides, and in cases where ordinary fixtures were heretofore suitable, it is now necessary to devise fixtures that embody semi-automatic clamping devices so that loading time is reduced to a minimum. Sometimes it is necessary to perform several operations in a fixture, such as aligning, locating, and clamping various surfaces, all by the operation of a single handle.

If enough thought is given to the application of tungsten-carbide tools, there always seems to be some better way that a given job can be done. The origination of new ideas and methods, rather than the practice of carrying out procedures that have been satisfactory in the past, is the way to achieve these superior results.

Minimizing Errors in Drawings

A. BEUSCH
Tool Designer

Much has been written and said as to whether or not to check drawings. While I do not think an infallible draftsman has yet been found, there are ways for him to minimize errors in dimensions before turning his drawing over to the checker.

First, a layout should be made clearly showing the general design of the machine. This layout is discussed and is either approved as is, or certain changes are recommended. After final approval, the next step is to make drawings of all the details, using the approved layout as a guide. After all dimensions have been determined, the assembly drawing is made.

This drawing is made in the same way as the machine is to be assembled in the shop. The parts are put together on the drawing according to their dimensions. In this way, the drawings of the details are being checked, since any errors in dimensions can be corrected and any missing dimensions can be added. By this method it is possible to make drawings having a minimum of errors.

Exit Wood in Boeing Planes

NEW uses of metal in aircraft manufacturing, culminating in the all-metal plane of 1932, have called for new processes and new manufacturing methods. As some engineers have changed their airplane designs, others have had to change their plant methods. Metal processing machinery has taken the place of wood working equipment. That, at least, is the picture at the plant of the Boeing Airplane Company in Seattle, one of the largest aircraft manufacturing firms in the world. Here all-metal military planes and all-metal commercial transport planes are being produced side by side. Metal processing equipment at the plant will reach a new high point with the production of a fleet of high-speed, twin-engined, all-metal commercial transport planes for United Air Lines.

The new transport holds large interest for the metal industry, because of its type of constructon. The plane will carry ten passengers, two pilots and 500 lbs. of mail and express, will cruise at 155 m.p.h., and have a top speed of 175 m.p.h. at an altitude of 5,000 ft., will be equipped with two supercharged 550-hp. Wasp engines mounted forward of the leading edge of the wing, and will have retractable landing gear.

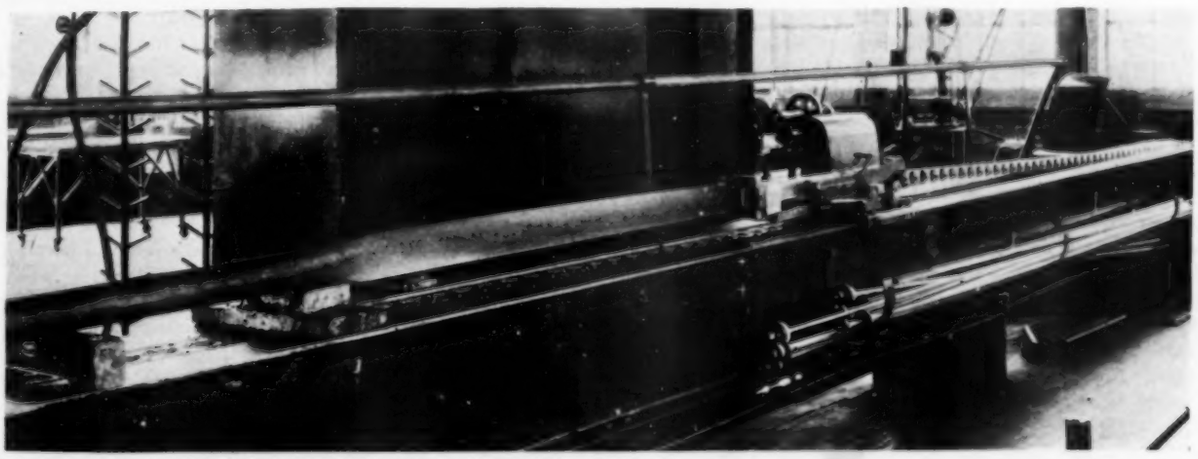
Tubing and channels for this plane, as for other metal planes, will be formed on a draw bench as shown. Duralumin for the airplane skins, bulkheads and cowling will be handled on a 700-ton hydraulic press. Various other shops will contribute their share of the work. The draw bench and hydraulic press are two of the innovations adopted with the use of metal at the Boeing plant. The bench is a 40-ft. device with an endless chain running the length of it, the chain being operated from an electric motor. At one end of the bench is a vise which holds the dies used. Tubing and channels are produced by attaching metal to the chain and drawing it through the dies—the form of die, of course, depending on the form of tubing or channel desired. Duralumin and steel tubing is handled on this bench, in addition to sheet stock in cases where pieces of considerable length and of the same section are required. Tubing of from 0.035 to 0.250 in. in wall thickness and sheet metal of from 0.016 to 0.091 in. thick have been put through the machine. The widest piece of metal used on the bench has measured 5¾ in. The tubing generally is from 12 to 16 ft. in length, with shorter pieces obtained by cutting.

The draw bench has approximately 80 dies for channels, 100 dies for tubing and 100 drawing dies, giving some idea of the amount and variety of work which the machine handles. Its chain moves about 15 ft. a minute.

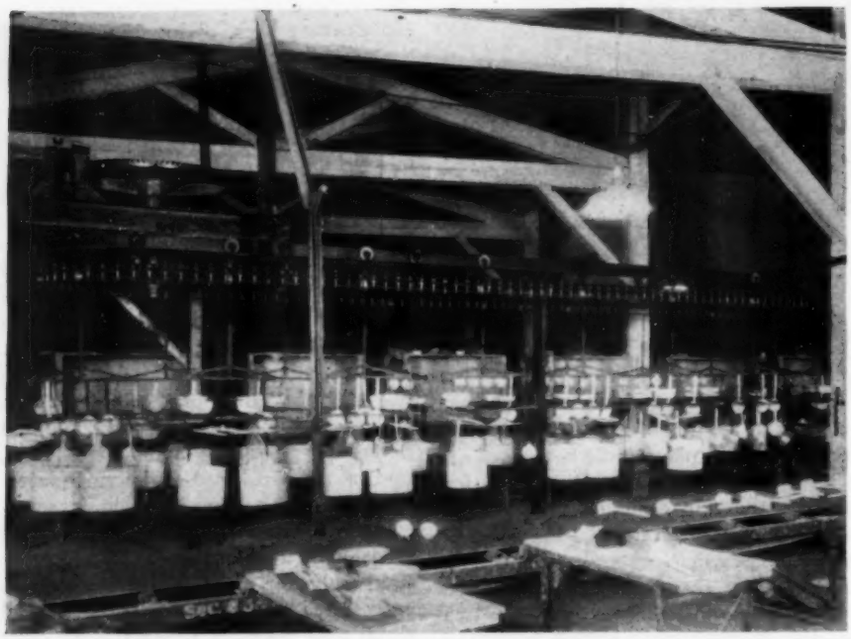
The 700-ton hydraulic press has a bed measuring 60 by 120 in. There are between 300 and 400 dies, both of the wood and steel type for this equipment. Another hydraulic press of 40 tons is used for smaller pieces. This is operated from city water pressure while the large press is equipped with a booster pump to raise its pressure from 40 to 700 tons.

Every metal part going into Boeing planes is treated to protect it from rust and corrosion. Duralumin and aluminum parts are given the anodic treatment, and steel parts are cadmium plated. The anodic treatment, which is something the reverse of electroplating since it partially etches the metal, was first used only for Navy plane parts. Its success led to its later adoption for all dural and aluminum parts. A 3 per cent chromic acid solution is used for the treatment, with the parts suspended in it. Current from a special generator passes through the metal and the solution, with the result that everything immersed is oxidized with a transparent film.

The Boeing Company uses the following metals: chrome-molybdenum steel, for landing gear, engine mounts and tail wheels as well as for the inboard spars of the new transport plane; duralumin, for covering the plane body, wings and tail, as well as for most of the internal structure; stainless steel, for exhaust stacks and for ball and roller bearings; aluminum, for gas and oil tanks; bronze for bushings; steel or bronze, for gears, pinions and worm drives. All these metals with the exception of bearings and sometimes gears, pinions and worm drives, are purchased by the company as raw material. Their fabrication gives an idea of the self-contained nature of the plant and its equipment.



Drawbench for tubes and shapes used in the new metal planes



Loading end of conveyor of continuous furnace heating kitchen ware

Vitreous Enameling in Continuous Furnaces

R. M. CHERRY

Industrial Engineering Dept., General Electric Co.

THE CONTINUOUS furnace for fusing wet process enamel is a fairly recent development. The first successful one of production size was an electric furnace placed in operation in 1922. Since that time more than 50 continuous furnaces have been installed.

As compared with the box-type furnace the continuous furnace provides for larger production per unit of floor space, requires less labor for a given production, permits slow heating and cooling of the ware, thereby decreasing warping, gives a definite time-temperature cycle, and makes it possible to conveyorize completely the entire line of production.

Whether or not the continuous furnace should be used instead of a box-type furnace depends upon the production of a particular ware and the plant layout. As a general rule, when the production is such as to require two or more large box-type furnaces, a continuous furnace is justified. For flat ware this means a minimum production of about 1,200 sq.ft. single coat per hr. and for cast iron a minimum production of about 2,000 lb. single coat per hr.

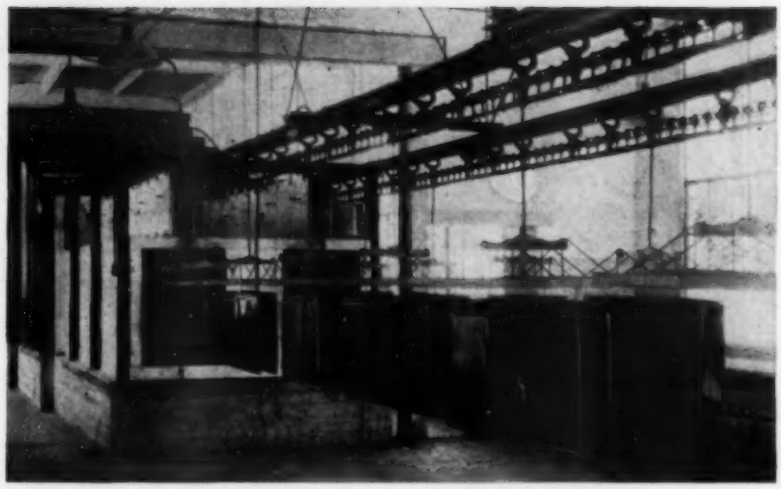
In order to improve furnace efficiency, the raised-end heat-seal feature was applied to the electric furnace. It consists essentially of a horizontal preheating oven, an inclined preheating chamber and a horizontal heating chamber. The heating chamber is elevated so that its floor is higher than the top of the front opening of the entering end of the furnace.

The forged steel monorail conveyor is located in a closed chamber above the furnace chamber. Vertical rods extend down from the conveyor through a slot in the furnace roof into the furnace chamber, and engage with racks for supporting the ware. The conveyor makes a U-turn at the end of the heating chamber and extends out in front of the furnace a suitable distance for unloading and loading of ware.

Doors at the entering end of the furnace and at the front of the heating chamber are closed when the furnace is shut down over night or week ends, thereby decreasing heat losses during such idle periods, and also the time for heating the furnace to operating temperature. When the furnace is to be shut down, the racks are removed from the conveyor, which can be done in a very few minutes, and the doors are closed. The conveyor is kept running until the furnace chamber has dropped to a temperature of approximately 1,200 deg. F.

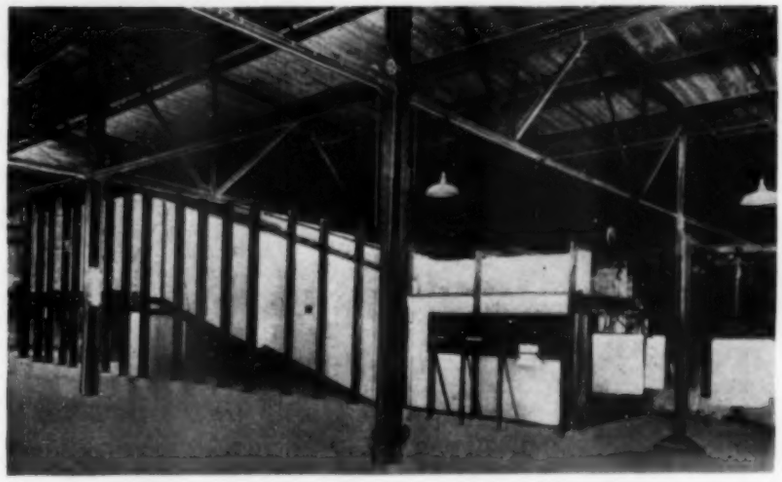
The effect of the raised-end heat seal is clearly demonstrated by admitting smoke at the entrance end of the furnace and observing the path the smoke follows. The smoke travels through the horizontal preheat oven and part way up the incline where it turns upward and back toward the entrance end of the furnace. This simple test shows that there is practically no air current carrying heat out of the heating chamber where all the heat is supplied.

The total energy consumption of the continuous furnace is determined by the standby losses, energy to heat furnace



Electric continuous raised end heat seal furnace used for heating sheet steel stove parts

Rack for heating miscellaneous kitchen ware in a continuous furnace



Side view of an electric continuous raised end heat seal furnace used for heating flat ware

after the shutdown period, and the heat that must be supplied in the heating chamber to the ware and racks. For a given furnace and a given furnace temperature the standby losses and energy to heat up after shutdown periods are fixed factors, but the heat required by the ware and rack depends upon their weight and the amount of heat compensation obtained in the preheating section.

Actual operating data taken from several sizes of these furnaces for kitchen ware, flat ware, refrigerator liners and cast iron follow. In the dimensions given the width and height are the actual inside clearance dimensions, the length of the heating chamber includes the U-turn and both sides of the heating chamber, and the length of the preheating chamber includes the length of both the inclined and horizontal sections.

The figures given do not represent the maximum production or the highest economy but were taken from regular production runs.

An installation of a furance having a rating of 620 Kw., furnace dimensions 33 in. wide, 50 in. high, heating chamber 37 ft., and preheat chamber 66 ft. long, heating ground coat at 1,600 deg. F. and cover coats at approximately 1,540 deg. F., gave the following results when heating gray ware. The conveyor speed was 11 FPM, production 2,480 lb. net ware per hr. and 9,500 lb. racks per hr., giving a gross weight of 11,980 lb. per hr. The energy consumption was 580 Kwh. per hr., giving a net economy of 4.3 lb. of ware per Kw.-hr. or a gross economy of 20.7 lb. per Kw.-hr.

An installation of a continuous furnace having a rating of 550 Kw., inside dimensions of 33 in. wide, 50 in. high, heating chamber 38 ft. long, preheat chamber 66 ft. long, used for heating flat sheet steel, gave the following results. The production was 3,300 sq.ft. of 18 gage sheet steel (6,600 lb.) and the energy consumption was 450 Kwh. per hr., giving a net economy of 14.6 lb. per Kwh.

A continuous furnace with a rating of 620 Kw. and having inside dimensions of 33 in. wide, 50 in. high, heating chamber 38 ft. long, preheat chamber 51 ft. long, gave a production of 175 refrigerator liners per hr. The gross weight per hr. was 6,475 lb., of which 4,725 lb. was net weight. The total energy consumption per hr. was 425 Kwh., giving a net economy of 11.1 lb. per Kwh. or a gross economy of 15.2 lb. per Kwh.

Cast iron enamel is fused at a lower temperature than sheet steel enamel and the time in the furnace is longer due to the lower temperature and the heavier parts.

For an installation of a continuous furnace heating cast iron stove parts, the furnace dimensions were 20 in. wide, 40 in. high, firing chamber 25 ft., preheat chamber 31 ft., furnace rating 225 Kw., gross production 3,000 lb. per hr., of which 2,500 lb. was net weight, the energy consumption was 200 Kwh. per hr., giving a net economy of 12½ lb. per Kwh. or gross economy of 15 lb. per Kwh.

Courtesy of Worthington Pump & Machinery Corporation *Photo by Rittase*

A million minute cutters whirl

bonded in a single wheel

EDITORIALS

AMERICAN MACHINIST
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McGRAW-HILL PUBLISHING COMPANY, INC.
K. H. CONDIT F. H. COLVIN
EDITORS

Modernization Throughout Industry

It will be good news to the metal-working industry that a general campaign aimed to promote equipment modernization in every branch of industry is now under way. Last Friday's meeting of the Associated Business Papers in the McGraw-Hill Building marks the culmination of plans that have been in the making for nearly two years. All ready to shoot last January, the sponsors of the campaign were convinced by Government officials that the time was not right, largely because of the precarious credit conditions then existent, and action was postponed.

Today the credit situation is vastly improved, commodity prices have started upward and there are signs of reviving confidence in the fundamental soundness of the business structure. There is every reason to believe, therefore, that a modernization campaign has a fair chance of success. Certainly there is a crying need for new machinery in all kinds of plants, no matter what the product. Our 1930 survey showed an obsolescence percentage of forty-eight. Now, two years later, the picture is considerably worse. Manufacturers are paying for it in needlessly high production costs, which are hard to pass on to the consumer in this market.

Every order placed for a new machine in a textile mill, a food factory, a printing establishment or an automobile plant means business for a metal-working shop and work for men in that shop and in the works of companies from which that shop buys its materials and parts. Hence the keen interest of the whole metal-working field in a campaign that preaches modernization to all industry. May it be effective, and soon.

Ethics and Efficiency in Buying and Selling

Buying and selling are so closely related that it is hard to understand why some concerns have different codes of ethics for the two transactions. They deprecate price cutting in their sales and then applaud their purchasing agent when he browbeats a supplier down to a low, and probably unprofitable price level.

There are two sides to the question, of course, perhaps more. As one notoriously hard-boiled purchasing agent puts it, "I wish every supplier had a fixed price. We have a few who always quote their real price at first and I take it or leave it. The great majority, however, quote a 'bargaining price' and it's up to me to get the *real* price for my company. It would save time and money for everyone if price cutting were abolished. With prices to everyone where they should be, the inefficient would soon be forced out of business and we would all be better off."

The purchasing agent who buys below a fair price restricts the buying power of the concern which sells to him. And this tends to prevent the sales of the purchaser's own products, either directly to that seller, or to those from whom he would normally buy.

Ethics can, and should, apply as much to buying as to selling.

Railroad Critics and Research

Criticizing the railroads has long been a favorite pastime. And, while much of the criticism has been unwarranted because of a lack of understanding of the problem, there has been plenty of reason for some of it. Broadside attacks in sweeping generalities, such as the claim of the late Harrington Emerson that the railroads were wasting a million dollars a day because of out-of-date shop equipment and practice, had enough truth in them to arouse the ire of railway executives. Few of us mind attacks that have no foundation in fact.

One of the latest criticisms claims great losses to the railroads because of lack of research. Here again there is enough reason behind it to arouse antagonism. As the critic happens to be in general merchandising there is great opportunity for ridicule. But, as with most sweeping criticism, there are notable exceptions that weaken the general statement. As a matter of fact, considerable research has been and is being done, some of it through the American Railway Association, as is eminently proper. Railroads have so many problems in common that nearly all research might well be carried on by their central body.

Many railroad executives feel that the number of types of locomotives can be greatly reduced, and a considerable saving effected both in operation and maintenance. Such a step would not only reduce the cost of carrying spare parts but would also simplify machining operations in the shops.

Tests on types of locomotives for various service, of bearings, lubricating systems and other details can be made at less cost by a single group than by a number of railways, and cost is an important item. Simplification of types of locomotives, and such details as crankpins, bearing and shoes and wedges, will help reduce the cost of operation. Centralized research, rather

than hit-or-miss experimentation, will benefit the entire railway group.

Similar research might well extend to shop equipment and shop practice, not with the idea of imposing fixed standards or methods on all shops but to aid in eliminating both machines and methods that are obsolete. Even though we resent criticism by those in other lines of industry, they can frequently point out poor practices that we overlook because we have grown accustomed to them.

Standardization does not mean that no new types of locomotives will be developed, but rather that spasmodic designing and testing by individual railroads would give way to organized research in the interest of the whole industry. Whether the railroads combine into a few great lines or not, they are all part of the greatest transportation system in the world and must work together.

• CHIPS •

President Hoover announces start of work on reorganization of administrative departments . . . will place plan before Congress in December . . . Relief Conference meets in Washington . . . decides on same general type of effort as last winter's . . . Legion votes for immediate payment of bonus and draws hot fire of resentment . . . Hoover squarely against it, Roosevelt silent . . . Hoarded money returning to circulation at estimated rate of $25,000,000 weekly . . . rising commodity prices largely responsible . . . Department of Labor reports more employment in August . . . borne out by reports from several states . . . Railroad executives and union leaders meet informally in Washington . . . Eastern R.R. executives approve consolidation plan, except as it affects New England.

New York department stores report heavy September buying . . . 50 per cent ahead of last year . . . White and Studebaker directors vote approval of merger plan . . . stockholders must ratify . . . Graybar studies potential market for homes and domestic equipment including automobiles . . . estimates total volume of forty billions, when income is adequate . . . Pennsylvania R.R. receives its $2,000,000 R.F.C. loan for building steel cars . . . New Haven asks for $700,000 to repair locomotives and freight cars . . . means work for 400 . . . United Aircraft gets orders amounting to a total of $1,500,000 for planes, engines and propellers from Persian and Brazilian governments . . . American Radiator buys 50,000 tons of foundry pig iron . . . important barometric indication because of bellwether position of Arco . . . Electric power output 11.2 per cent below corresponding week of 1931 . . . trend steadily upward.

Germany functions under what is essentially a dictatorship . . . plans reconstruction of business and industry . . . upsets disarmament apple cart and stirs up a barrage of notes . . . Japan recognizes Manchukuo amid general celebration . . . China wants to know what we are going to do about it . . . cites 9-power treaty . . . Ambassador Edge comes home ostensibly to discuss new French commercial treaty with State Department . . . Rykov "Right Opposition" urges breathing space between first and second five-year plans in U.S.S.R. . . . industrial plants falling far behind their programs in most instances.

Chemical and Metallurgical Engineering gives statistics on corrosion-resistant materials in its September number . . . rapid growth of activity in development of these materials evident from this comparison —250 reported now, 115 in 1929, 75 in 1924 . . . Stainless steel beer kegs to replace the traditional wooden ones have been developed . . . used in Europe for other varieties of brewing equipment . . . Western coal mines have rebuilt tipples to accommodate motor truck transportation as well as rail haulage . . . Navy expenditures of $10,000,000 for navy yard and shore station maintenance and expansion involve at least $1,000,000 for land power plants and equipment . . . Pawling & Harnischfeger ship 300-ton power house crane to Diablo Dam development in Washington . . . Peters Cartridge Co. develops electronic device for recording pressures in shot-gun barrels.

Copper maintains its price in the domestic field during past fortnight . . . World stocks decline 3,000 tons . . . lead and zinc prices off slightly . . . lead stocks down 5,000 tons . . . Pocket portable radio set developed in England . . . designed for police use it weighs less than two pounds . . . may stimulate American inventors to develop similar sets, which is fine as long as no loudspeakers go with them . . . Navy launches all-welded lighter . . . largest yet built by Navy, it is 120 ft. long, carries 250 tons.

Work on Dotsero cutoff starts at once, thanks to R.F.C. loan to Denver & Rio Grande Western . . . Los Angeles aqueduct expected to benefit from same source . . . New York Port Authority inland terminal covering a whole city block is turned over to the eight railroads that will use it . . . Passengers carried by air transport increased 17 per cent during first seven months of 1932 over same period of 1931 . . . Miles flown increased 89 per cent . . . United carried 12,000 passengers in August . . . Brooklyn rebuilds 150 street railway cars.

A.B.P. Cooperates in Rehabilitation Move

To supplement the work of A. W. Robertson and his national committee on industrial rehabilitation, the Associated Business Papers, Inc., has organized to do its part in this move to promote business recovery. This action was first thought of in April, 1931, but at that time it was realized that the opportunity for achieving positive results was limited. The economic trend eighteen months ago was such that efforts to promote the expansion of capital expenditures were certain to be neutralized by the downward swing of business activity.

In the formation of the Robertson group last month (*AM*—Vol. 76, page 972c), A.B.P. members saw a chance to lend their weight to the cause of rehabilitation. Accordingly the following committee was appointed by James H. McGraw, Jr., A.B.P. president:

MALCOLM MUIR, President McGraw-Hill Publishing Co., Inc., *Chairman*.
E. H. AHRENS, President Ahrens Publishing Company, Inc.
PAUL I. ALDRICH, Vice-President The National Provisioner, Inc.
ARTHUR ANDERSON, Editor Boot and Shoe Recorder.
ROY DICKINSON, Vice-President Printers Ink Publications, Inc.
SAMUEL O. DUNN, Chairman Simmons Boardman Publishing Co.
T. S. HOLDEN, Vice-President F. W. Dodge Corporation.
H. C. PARMELEE, Vice-President McGraw-Hill Publishing Co., Inc.
A. C. PEARSON, Chairman, United Business Publishers, Inc.
WARREN C. PLATT, President National Petroleum News.
EARL L. SHANER, Chairman National Conference of Business Paper Editors.
C. J. STARK, President Penton Publishing Company.
J. H. VAN DEVENTER, Editor The Iron Age.
ROY V. WRIGHT, Vice-President Simmons Boardman Publishing Company.

In a meeting held September 23, in the McGraw-Hill auditorium, Mr. Robertson outlined the operating plans of his committee and suggested ways in which the business press could aid in making its work effective. Mr. Robertson emphasized that a selling campaign was not part of the program. The move is essentially one to stimulate buying on the part of industrial executives, not because of altruistic motives but by convincing them that it is to the interest of their firms to put their plants in order at this time.

Rising commodity and security prices indicate a change, Mr. Robertson said, and rather than wait for renewed activity, we should go to meet it. Firms taking the opportunity to modernize now can do so at less cost and at less disturbance to production than when the volume of orders increases.

Mr. Robertson said that the program did not include the financing of equipment or the creation of credit supply. It is directed solely to those firms having liquid funds that would be better invested in equipment in anticipation of greater manufacturing activity.

District Chairmen Announced

A. W. Robertson, chairman of the National Committee on Industrial Rehabilitation, announced on September 26 the names of the business leaders who will serve as chairmen of the committees to be formed in each Federal Reserve district. The names of these men follow:

First district—Boston: H. C. KNIGHT, president of the New England Council and president of the Southern New England Telephone Co.

Second district—New York: MAJOR-GENERAL JAMES G. HARBORD, chairman of the board of the Radio Corporation of America.

Third district — Philadelphia: JOHN E. ZIMMERMAN, president of the United Gas Improvement Co.; vice-chairman, CHARLES BRINLEY, president of the American Pulley Co.

Fourth district — Cleveland: RANDOLPH EIDE, president of the Ohio Bell Telephone Co.; vice-chairman, GEORGE C. BRAINARD, president of the General Fireproofing Co.

Fifth district—Richmond: W. H. MEESE, vice-president of the Western Electric Co.; vice-chairman, J. E. SIRRINE, president of J. E. Sirrine & Co.

Sixth district—Atlanta: THEODORE SWANN, president of the Swann Corp.

Seventh district—Chicago: Yet to be announced.

Eighth district — St. Louis: ALBERT C. ELLAS, president of the Southwestern Bell Telephone Co.; vice-chairman, P. B. POSTLETHWAITE, president of the Wagner Electric Co.

Ninth district—Minneapolis: R. F. PACK, president of the Northern State Power Co.

Tenth district — Kansas City: FRANK MOSS, president of the American Sash & Door Co.

Eleventh district—Dallas: R. L. THORNTON, president of the Mercantile National Bank & Trust Co.; vice-chairman, R. C. KULDELL, president of the Hughes Tool Co.

Twelfth district—San Francisco: WILLIAM A. ROSS, vice-president of the Columbia Steel Co.; vice-chairman, J. A. CRANSTON, General Electric Co.

In each district, sub-committees will be formed in the industrial centers.

• INDUSTRIAL REVIEW •

Although a few orders for machinery drifted into machinery builders' and dealers' offices during the past fortnight, progress from the low point of late July was disappointing. Much is hoped for from the Robertson Committee, which has just announced its regional chiefs and also the cooperation of the business press. Employment conditions are better in some districts.

In Detroit Chevrolet built more cars in September than had been planned and small equipment orders were placed by several automobile builders. A few men went back to work. From Indianapolis comes word that Chrysler is getting its new line ready for production and that International Harvester is equipping its Fort Wayne plant to build truck units formerly purchased outside. Little change is reported from Cleveland, machine tool dealers expecting hardly anything from September. Harris-Seybold-Potter, printing machinery manufacturers, booked several gratifying orders and Warner & Swasey has orders for two telescopes. Small shops are faring better, many of them being busy on new or revived orders. Chicago Pneumatic Tool is working its Cleveland plant more hours, and the Equipment Works of G. E. Lamp has stepped up from four days to five.

A real order or two was placed in Pittsburgh and it is reported that American Sheet & Tin Plate will start up its Monessen plant with 1,200 men and its Farrell plant with 1,800. The same company is to spend $2,500,000 in improving its Gary, Ind., and Bradford, Pa., plants. 1933 budgets are beginning to demand attention. Philadelphia finds business no better. Boston says that New England is improving. More inquiries are coming in and orders for repair parts are picking up sharply. Some real orders for new machinery are approaching conclusion. In the New York territory there is nothing to report except the placing of some punch press orders. One builder had one order each day last week and five on the preceding Saturday.

Business is somewhat better in St. Louis. Curtis Wright Mfg. Co., airplane builders, have increased operations one-third and are now running at about 50 per cent. The St. Louis plant of the Pittsburgh Erie Saw Works is running at capacity. Lewis Invisible Stitch Machine Co. reports a decided improvement in sewing machine orders and prospects. In Milwaukee and surrounding territory the failure of business to improve is offset by joy at the decisive overthrow of the LaFollette machine. Cincinnati is equally dull, although there have been more inquiries lately, and there is a feeling that the Maine election has acted to stifle recovery.

One fair-sized order, at least, was placed in Chicago and some of the small tool and specialty shops are busy. W. C. Grunow has equipped a plant to build refrigerator units and the Williams Oil-O-Matic Corp. is very busy on oil burners. Additional men have been put on by Battle Creek Bread-Wrapping Machine, Bendix Mfg., Rock Island Mfg., Silvis Shops of the Rock Island, and A. O. Smith.

McGraw Award Goes to Swope

Judges appointed by the National Electric Manufacturers Association have awarded the 1932 medal and purse, given under the James H. McGraw Award, to Gerard Swope. This was in recognition to the advancement of the industry through development of a plan for stabilizing employment. The presentation was made at a meeting of the N. E. M. A. on September 26.

Screw Threads Surveyed

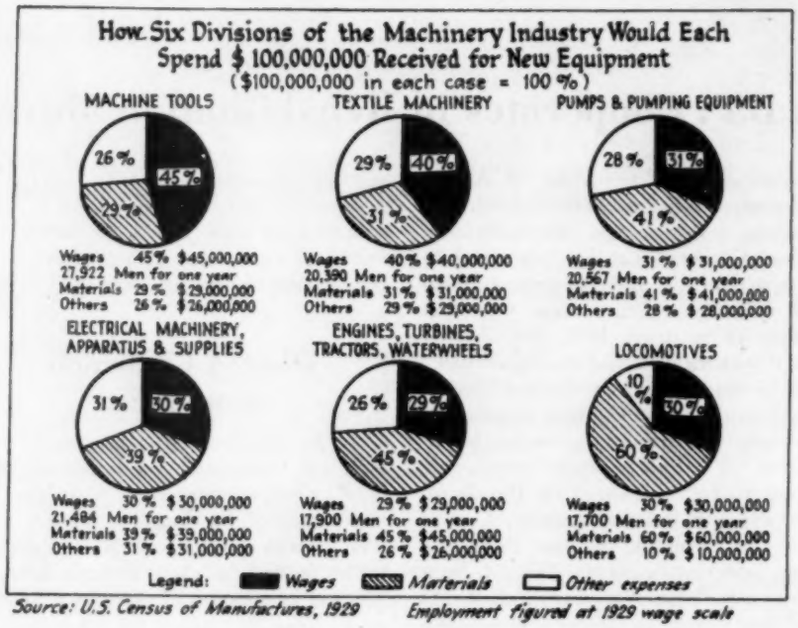
The A.S.M.E. sectional committee, of which Ralph E. Flanders is chairman, with the Bureau of Standards cooperating, recently made a study to show:

1. The actual state of screw-thread standardization in the United States.

2. The range of accuracy desirable for acceptable product of given class.

3. The range of accuracy commercially obtainable.

For this purpose 7851 threaded samples of screws, studs and nuts were obtained from 128 manufacturers and measured. These were listed according to the highest classification in which they fell regardless of specification. Of the interesting information compiled is the following: 17.2 per cent in Class 1; 20.5 per cent in Class 2; 29.9 per cent in Class 3; 9.8 per cent in Classes 4 and 5; 17.4 per cent oversize or too large; 5.2 per cent undersize or too small.



Source: U.S. Census of Manufactures, 1929 *Employment figured at 1929 wage scale*

Where Metal-Working Dollars Go

An interesting analysis of new orders in various divisions of the metal-working industry is based on percentages obtained from the 1929 Census of Manufactures. Assuming that each division receives orders for $100,000,000 worth of equipment, the resulting expenditures are broken down into labor, material and other outlay.

The accompanying chart gives the results. For example, the machine tool division would use 45 per cent of its $100,000,000 for wages which would keep 27,922 men employed for one year.

While this increase in the volume of orders for machine tools may sound fantastic to some, it should be remembered that the actual decrease in the dollar value of manufacture in this field exceeded $130,000,000 between 1929 and 1931.

Exports of Machinery During August, 1932

	August, 1932	July, 1932	August, 1931
Power-generating machinery except electric and automotive	$299,832	$357,288	$566,592
Construction machinery	306,686	339,482	1,103,973
Mining, well and pumping equipment	797,863	1,210,931	1,402,633
Power-driven, metal-working machinery	992,903	604,123	2,960,326
Other metal-working machinery	139,972	109,090	348,323
Textile machinery	282,752	346,901	455,169
Electrical machinery	2,423,656	3,065,395	2,960,326

Exports of Metal-Working Machinery During August, 1932

	August, 1932	July, 1932	August, 1931
Engine lathes	$46,741	$59,023	$228,533
Turret lathes	.....	560	48,418
Other lathes	19,136	48,439	381,152
Vertical boring mills and chucking machines	16,096	7,494	169,266
Thread cutting, automatic screw machines	10,880	898	58,650
Knee and column type milling machines	47,436	16,234	44,169
Other milling machines	59,437	2,996	270,151
Gear cutting machines	28,995	23,525	89,873
Vertical drilling machines	1,546	2,283	10,680
Radial drilling machines	.....	17,330	17,792
Other drilling machines	1,466	9,557	91,406
Planers and shapers	4,222	6,438	73,512
Surface grinding machines	9,256	16,836	99,047
External cylindrical grinding machines	37,745	7,483	224,645
Internal grinding machines	17,236	12,919	62,860
Tool grinding, cutter grinding and universal grinding machines	18,545	11,257	35,388
Other metal grinding machines	17,571	16,035	53,103
Sheet and plate metal working machines	495,438	128,992	198,192
Forging machinery	7,881	61,668	171,411
Rolling-mill machinery	1,197	9,247	127,419
Foundry and molding equipment	18,600	29,087	172,509
Other power-driven metal-working machinery and parts	133,479	115,822	332,149
Related Exports			
Pneumatic portable tools	17,939	15,396	54,414
Machine-operated pipe and thread, cutters, stocks, dies, taps, and other machine-operated cutting tools	89,755	45,308	171,995
Other metal-working machine tools	12,474	22,371	70,133

German Railroads Plan New Equipment

Hopes of improvement in the German metal-working industry have been stimulated by the decision of the railroad corporation to spend 280,000,000 marks on equipment in addition to the 800,000,000 marks already included in the budget. Exports of automobiles have risen, and the decline in automotive production has ended. Hamburg steel exports to Sweden, Denmark and Argentina have increased and the Belgian demand is steady.

Other industries show even greater improvement. Textiles, paper and pottery are increasingly active with higher prices and wider employment.

Metal Exhibits at Bottlers' Convention

With the manufacture of bottled carbonated beverages almost completely mechanized, the 7,500 plants in the industry are large users of a great variety of metal products, the makers of which will be well represented at the Interna-

tional Beverage Exposition to be held in conjunction with the annual convention of the American Bottlers of Carbonated Beverages in Cleveland, Ohio, November 14 to 18.

Besides automatic machinery, especially designed for mixing beverages, washing, filling, capping, labelling and packing bottles, there will be exhibits of pulleys, power transmission specialities, piping, castings, mixing and storage tanks, filters, sterilizers and stills.

Many Exhibits at Metal Congress

In conjunction with the Metal Congress, sponsored by the American Society for Steel Treating and five other technical societies, over 100 firms will exhibit in the Exposition held in the 174th Regiment Armory in Buffalo on October 3. In addition, eleven metal-working plants in and near Buffalo will open their doors to the visitors.

Morning technical sessions will be held at the Hotel Statler and afternoon meetings at the Armory. Programs of the papers presented by members of the A.S.S.T., A.S.M.E., A.W.S., and the S.A.E. Production Division were given in the last number. (*AM*—Vol. 76, page 1004d). The following additional papers will be read at meetings of the American Institute of Mining Engineers and the Wire Association.

A.I.M.E. Papers

A study of segregate structures in copper-tin and silver-zinc alloys, by DANA SMITH.

Copper Embrittlement II, by L. L. WYMAN.

Properties of Copper Deoxidized with Calcium, by LYALL ZICKRICK.

Effects of Inclusion Streaks on the Tensile and Dynamic Properties of Wrought Iron and Similar Materials, by F. R. HENSEL and T. F. HENGSTENBERG.

Effect of Small Percentages of Chromium on the Quality of Cast Iron, by E. O. BURGESS.

Analyses of Inclusions in High-Carbon Tool Steels, by HAAKON STYRI.

Directional Properties in Cold-Rolled and Annealed Commercial Bronze, by ARTHUR PHILLIPS and C. H. SAMAUS.

Ears on Cupronickel Cups, by W. H. BASSETT and J. C. BRADLEY.

Some Effects of Internal Stress on Properties of Drawn Brass Tubes, by D. K. CRAMPTON.

The Copper Rich Alloys of the Copper-Bickel-Tin System, by JOHN T. EASE and CLAIR UPTHEGROVE.

Intermediate Phases of the Iron-Tungsten System, by W. P. SYKES and KENT R. VAN HORN.

New Vacuum Valves and Their Applications, by A. W. HULL, Research Laboratory, General Electric Co.

Wire Association Papers

Material Handling in Wire Mills, by L. D. GRANGER, Wickwire Spencer Steel Co.

Plant Management, by JOHN C. COLLAGHAM, Steel Co. of Canada.

Cost Accounting, by R. F. COHN, Reynolds Wire Co.

Copper Rod Rolling, Wire Drawing and Annealing, by JOHN R. MCKEAN, American Electric Works.

Process Control in the Manufacture of Rubber Covered Wire, by E. S. STURTEVANT, U. S. Rubber Co.

Patenting, by R. B. WHYTE, MacWhyte Co.

Stainless Steel, by EARL SMITH, Republic Steel Corporation.

N.M.T.B.A. Appoints Lind as Manager

Directors of the National Machine Tool Builders' Association have announced appointment of HERMAN H. LIND of Cleveland as general manager. Mr. Lind has long been identified with various phases of industry such as executive direction of accounting, sales, engineering and manufacturing. He was

Photo by Bachrach

born at Canton, Ohio, and his first connection was with the Columbus Buggy Co. After two years he left this company to accept a position with the Ohio Body & Blower Co., with which he was identified for 17 years. During his association with that company, he worked his way up to the position of general manager. In 1920 Mr. Lind left the concern to engage in a consulting practice on problems in production and sales. Two years ago he was appointed general manager of the Malleable Iron Research Institute at Cleveland. A few months ago he returned to his consulting practice. Mr. Lind is 48.

International Exchange of Patents Planned

To counteract the damage to world trade caused by high tariff barriers and to stimulate trade between the United States and Germany, an effort is being made by the A. G. fur Amerika Interessen to promote the exchange of patents and manufacturing processes.

B. Lilienthal, president of this organization, suggests that at least part of the market lost through the decline of export markets be recaptured through license of patents or other arrangements whereby new products and manufacturing methods may be available in other than the country of origin.

• BUSINESS ITEMS •

SKF Industries Inc., New ork, supervising The Skayef Ball Bearing Co., Hartford, Conn.; The Hess-Bright Mfg. Co., Atlas Ball Co., and SKF Research Laboratory, of Philadelphia, has announced the consolidation of the manufacturing activities of The Skayef Ball Bearing Co. of Hartford with The Hess-Bright Mfg. Co. at Philadelphia. The complete line of products previously manufactured at Hartford will be continued at Pphiladelphia.

ABEL DAVIS and FRANKLIN H. FOWLER, receivers in equity for the Foote Bros. Gear & Machine Co., announce that arrangements are being made to move all manufacturing operations of the company now being carried on at the Curtis St. plant, to the Plamondon Division at 5301 S. Western Ave., Chicago. This consolidation of the manufacturing operations of the gear and reducer divisions in a modern plant will effect savings in production costs and operating expenses and will speed up deliveries. It is expected that the move will be completed by about Oct. 1.

The Murchey Machine & Tool Co., Detroit, Mich., has appointed the C. D. Proctor Co., 30 Church St., New York, N. Y., as representative for its line in the metropolitan district of New York and in the New England states. The New England office will be operated by H. F. MILLER, Slater Bldg., Worcester, Mass.

The Independent Lock Co. of Fitchburg, Mass., has purchased the Grant Yarn Mill of that city, and will move its Prescott St. plant and its newly acquired Lockwood operations from South Norwalk, Conn. This will mean the employment of 150 additional persons.

National Radiator Corp., Johnstown, Pa., manufacturer of steam and hot water radiators, has been purchased from receivers by a reorganization committee of bondholders, headed by JOHN H. WATERS, president. A new company will be formed to take over the plant and to resume operations at an early date.

Aresto Mfg. Co., 501 Calvert Bldg., Baltimore, Md., has leased a three-story building at 208 W. Camden St., and will equip it to do light machine work on the company's non-explosive gasoline tanks and cans, flame arresters and other equipment. SYDNEY S. WEIL is manager.

Sale of the plant and real estate of the Jordan Motor Car Co. to an unnamed purchaser for $150,000 was consummated recently.

• PERSONALS •

WALTER C. KEYS, consulting engineer, Detroit, Mich., has been elected a member of the Council of the Society of Automotive Engineers, Inc., to fill the unexpired term of the late FRED S. DUESENBERG. This selection was made in recognition of the services rendered by Mr. Keys over a period of a number of years. He has been a member of the Parts & Fittings division of the Standards Committee, and has served at various times on the Motor Vehicle Committee, the Sections Committee, the Riding Comfort Research Subcommittee, the Meetings Committee, and the Passenger Car Committee. Positions held by Mr. Keys in the industry include the following: assistant chassis engineer of the Cadillac Motor Car Co.; development engineer and assistant director of engineering of the Standard Parts Co., Cleveland, and plant engineer of the Eaton Axle Co.

EDWARD S. CHAMBERLAIN, machine tool salesman in the metropolitan territory since 1919 for the Van Dyck Churchill Co., New York, has opened an office at 39 Cortlandt St., New York. He represents Charles H. Besly & Co., Chicago; Barrett Machine Tool Co., Meadville, Pa.; Fosdick Machine Tool Co. and Bradford Machine Tool Co.

WILLIAM S. CULVER, district engineer of the East Central district of the General Electric Co., with headquarters at Cleveland, will retire from active duty at the end of September after 47 years with the company. W. J. HANLEY, commercial vice-president in charge of the district, has appointed C. W. FICK, assistant district engineer to succeed Mr Culver.

RALPH L. DUNCKEL, connected at one time with the International Motor Co., has been placed in charge of production and purchasing at the Bridgeport plant of the Kron Co., manufacturer of industrial scales.

D. W. MCLENEGAN has been appointed assistant engineer of the commercial engineering division of the General Electric air-conditioning department, according to a recent announcement by J. J. DONOVAN, manager. Mr. McLenegan joined the General Electric Co. in 1921, and was advanced to his present position from the industrial engineering department.

REAR ADMIRAL CHARLES B. MCVAY, U. S. N., member of the General Board, Navy Dept., will be retired from active duty on Oct. 1 and transferred to the retired list. From July, 1919 to June, 1920, Admiral McVay was at the Navy Yard, Washington, D. C., first as captain of the Yard and assistant superintendent of the Naval Gun Factory, later as commandant of the Yard and superintendent of the Gun Factory. In June 1920, he was commissioned chief of the Bureau of Ordnance, Navy Dept., with the rank of Real Admiral for a tour of four years.

BENJAMIN L. MAAS, formerly secretary and sales manager, Federal Screw Works, Detroit, is now connected with the Acme Machine Products Co., Muncie, Ind. Mr. Maas will be in charge of sales at the Detroit office in the Fisher Bldg.

G. E. TENNEY has been appointed sales manager in the Chicago district by the Lincoln Electric Co., Cleveland. Previous to joining the sales staff of the Lincoln organization, he was engaged in shop, engineering and sales work for the Houghton Elevator Co., Toledo; The Recording & Computing Machine Co., Dayton; and the Moore Drop-Forging Co., Springfield, Mass.

• OBITUARIES •

JOHN MUZIK, tool builder and designer at Geuder, Paeschke & Frey Co., Milwaukee, Wis., died Sept. 3. He was 56. Mr. Muzik was a native of Austria, and received his general and technical education in Graz and Vienna. After spending several years as toolmaker in the factories of Vienna and Berlin, he came to America about 25 years ago and became associated with the above concern. At his death, he was in charge of all tool and die work at the plant, and under his supervision tools were built that advanced the use of sheet metal in industry. His developments were prominent factors in making quantity production possible in such fields as automobiles, washing machines and business machines.

WILLIAM H. KLEPPINGER, president, Calumet Foundry & Machine Co., Chicago, died on Sept. 12. One of Mr. Kleppinger's early connections was as president of the Preble Machine Works, Chicago. In 1916 he organized the Gary Foundry & Machine Works, which was consolidated in 1919 with the East Chicago Foundry Co. to form the Calumet Foundry & Machine Co.

ROBERT T. ARMSTRONG, 61, formerly general manager of the Armstrong Spring Co., Flint, Mich., until his retirement four years ago, died recently.

GREGORY BETKE, 52, superintendent of the Western Machine Co., Milwaukee, died Sept. 2.

J. RAY COFFMAN, 47, founder of the Columbus Valve Mfg. Corp., Columbus, Ohio, died Sept. 11 following an extended illness. He was vice-president and general manager of the firm until its merger with the Michigan Valve Co., Detroit.

JOHN W. HOWE, 58, veteran machinist and mechanical engineer of the H. H. Franklin Mfg. Co., Syracuse, N. Y., and connected with that company for more than 20 years, died Sept. 15, following a brief illness.

THOMAS F. MCDONALD, 73, died at Dayton, Sept. 7. He organized the Dayton Brass Castings Co. in 1908 and headed the company until his retirement three years ago.

FRANK PROSSER, a member of the engineering firm of Thomas Prosser & Son, New York, N. Y., died Sept. 20, after a brief illness. He was 63 years old.

RICHARD D. PURCELL, treasurer and director of the Ingersoll-Rand Co., died recently. He had been with the concern for 45 years, and was also treasurer and director of the A. S. Cameron Steam Pump Works.

WILLIAM H. THOMPSON, 67, president of the Buffalo Metal Furniture Co., Buffalo, died recently. He founded the business in 1903.

• MEETINGS •

AMERICAN GAS ASSOCIATION. Fourteenth annual convention and exhibition, Atlantic City. October 10-12. K. R. Boyes, secretary, 420 Lexington Ave., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. National Machine Shop Practice Meeting, Buffalo. Week of October 3. Annual Meeting, New York, December 5-10. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING. December 5-10. Grand Central Palace, New York, N. Y.

NATIONAL METAL CONGRESS & EXPOSITION. 174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored By A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., S.A.E., and the Wire Association. W. H. Eisenmann, 7016 Euclid Ave., Cleveland, Director.

NATIONAL SAFETY COUNCIL. Twenty-first annual safety congress, Washington, D. C., Oct. 3-7. National Safety Council, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

THE ROUND TABLE

Slightly Worn

"Ed, you had a Smith boring mill, didn't you?"

"Yes, a Smith and a Regent."

"Which is the best in your estimation?"

"Well, I prefer the Smith mill for production, but I think the Regent would be better for toolroom work. It is accurate and handy, but it won't stand banging. It takes a good man to run it. Why?"

"Oh, we had a chance to buy a second-hand Smith. I was wondering how they stand up after they get worn."

"Well, I don't want to inherit any second-hand machine, especially a boring mill."

"Why do you emphasize a boring mill?"

"Oh, it's different. You can't tighten up the bearings, and if they need rebabbitting or reboring, it's a job for people who are equipped for the job and know exactly how to handle it. You can test the bearings of a lathe, but I'll be darned if I know any way of testing the bearings of a boring mill. What do you want a boring mill for, anyhow?"

"We're still having that trouble with failure of pressure, and as far as we can see, it's not old man Tucker's fault. Mason seems to think we'll have to buy a mill and do the machining ourselves."

"Will that one job justify the purchase of a boring mill?"

"Not entirely. We can do the frames and end plates on the same machine, and Mason seems to think that we may have to grind the ends of the rotor and the cylinder end bearings."

"I notice that you quote Mason all the time. What do you think about it yourself?"

"When I was with the company, Ed, I was always against buying second-hand machinery, and I am still against it. I told Mason I didn't like to start out that way in a new business because it gets to be a habit, and the first thing you know you know you have a shop with nothing but junk in it."

"Maybe, but some of the big automobile companies buy second-hand machines by the carload, I hear."

"Maybe they do, but it is rebuilt machinery, and they chuck it out in a year or two. In our case, it must last a lifetime."

"Can you afford to buy a new one, Al?"

"No. The price of a good boring mill of the size we ought to have to take care of normal increase in size of our compressors, is greater than our entire capital, on hand or in sight."

"Well, what are you going to do about it?"

"I don't know, Ed. I'm up a tree. It looks like a second-hand machine, or none. I don't like a second-hand machine, and at the same time, I don't like to do grinding on a new one. But if we don't cure that pressure leak, we won't need any machinery and I'll be back looking for my old job."

Do circumstances justify the partners purchasing an expensive machine at this stage of their business? What policy should they adopt concerning the purchase of second-hand machinery?

Discussion

Shall the Customer Furnish Gages?

Tucker is wrong about demanding gages for one piece only. The buyer could not be expected to furnish a gage for one part, particularly where that part is the first made and is experimental.

It is probable that what he really needed was to have the tolerance for parallelism of the surfaces shown clearly on the drawing. Too many drawings show a wide tolerance of dimension on two parallel surfaces without showing how closely parallel those surfaces should be. This subject, together with that of concentricity of holes and outside diameters, is most often neglected altogether on the drawings and becomes most troublesome in purchasing machine work.

There is no question about the general desirability of gages. They save many an argument, on wide tolerances as well as on close work, by providing a ready tool by which the correctness of the work may be quickly determined. However, it is too easy to make elaborate gages and then find that their cost has not been justified.

Much trouble caused by lack of gages can be avoided by thinking of the workman when making drawings. The drawings should be specific as to the desired tolerances, especially those which can be readily checked. —WILLIAM A. WALTER

In Our Own Shop or Outside?

There are many things to be considered in deciding when to put a job in an outside shop. It may easily happen that the outside shop has enough better equipment to do the work for

less money, even including their profit. On the other hand it may be better to do the work in your own shop, even at a somewhat higher cost, in order to keep your men. While theoretically no job should be taken without a profit, it is often necessary to consider "how will I lose the least." For rent, insurance and other items go on whether the shop runs or not. If you lose less than this by doing the job yourself you are better off than by letting the shop stand idle.

—Henry C. Francis.

Till it Hurts

The difficulty referred to does not, of course, apply to our country as it does to America, because of our unemployment scheme, whereby Government, employers and employed subscribing together, unemployed people receive a

living amount each week. This, of course, means an extra drain on those working. As suggested by Ed., rates, taxes, and various funds are a strain on all of us, and self-denial has to be practiced. But real sympathy necessarily costs something, and unless talk, argument and ink end in action, touching our pockets and curtailing selfish indulgence, it misses its mark.

—Wm. Bryce, *Sheffield, England.*

Divided Responsibility

There is no objection to letting out parts of a machine to another shop so long as you have a competent man to check the parts when received. It is not unusual for a machine shop to take a contact to build a machine when they know it will be necessary to sublet some of the parts.

The only trouble I ran into along this line was on one of the early jobs. One of the important pieces that we received would not fit to the parts we had manufactured in our own shop. The fault lay in the drawings for our draftsman had just given a single dimension for everything. We could not exactly blame him because that is our practice, for we employ only competent men who know what the tolerance should be. In this case, however, the shop which took the subcontract was apparently interested in doing the least work possible and left some rough and inaccurate surfaces. They alibied by saying that everything was within the customary limits—whatever that may mean.

We promptly stopped anything like this from happening again by giving the plus and minus on all future outside drawings and also by specifying the surface required if it was important. Since doing this, we have had no more arguments, although several times we have had to reject work, and the subcontractor has had to refinish or make a new piece. In every one of these cases, our checker had no difficulty in showing where the piece did not come within our limits.

There was one thing, however, that we never did, and that was to expect the other shop to do better and more accurate work than we could do. Any time we demanded more accuracy, we were ready to supply a man who could produce what we wanted. I also think this talking point of ours successfully blocked any claims that we were asking too much. Furthermore the drawings on which the bid was made were the actual working ones. Some folks get a bid on an assembly drawing with few dimensions and then let loose a lot of details with 0.0002-in. tolerances—an accuracy the contractor has not figured on and for which he should get a much better price.

—George P. Pearce.

Shifting the Burden

Mechanical improvement means lower unit cost. This is almost universally agreed upon. The trouble with management today is its attempt to hold on to all machinery and buildings, even though, with better methods, it can do the same work with half as much. This results in price wars to try to increase the percentage of business. A company loads up its customers' shelves with bargains. These goods do not move at any price, as they exceed the needs of the consumers. The final result is that, with the heavy overhead and ruinous prices, the manufacturer loses more than the savings he makes on his better equipment and finally must shut down because he cannot find any further market for his goods.

How about the employee? On account of the heavy overhead, his wages must be kept down to try to meet costs, and when the market becomes glutted, he is laid off. He is told, however, he will be sent for as soon as business picks up, so he does not often try to learn a new trade. If he is fortunate, he gets a fill-in job until he is sent for.

If those who make mechanical improvements would be satisfied to hold their normal share of the industry's business, or at least take an additional amount considerably below the need for price cutting, they could sell off or write off their excess equipment.

If the manufacturers would keep up-to-date on machinery, equipment, and methods, scrap or dispose of old machinery and unused floor space, and in boom time, run extra shifts instead of expanding, they would fluctuate with the times and not cut each others' throats when business drops to normal, glutting the market and causing hard times. The extra shifts would cost more, but could be well afforded as prices are at their peak when such a step is necessary.

—William D. Plumb,
Factory Manager,
Fayette R. Plumb, Inc.

Overloaded

Williams' plan will work, provided always that some classes of workers don't try to kill it. This plan was tried out successfully during the war at Rock Island (Ill.) Arsenal. Here they needed a multitude of small cutters for wood, used in turning and finishing operations on the stock of the Army rifle. These cutters had been put through in lots of 500, but the three men assigned to the work could not keep up with the breakage.

At last it became a question of producing more cutters or shutting down the stock-turning machines. Finally the superintendent of manufacture told me to go ahead with my plan. The shop had installed four new milling machines, which were assigned to the best tool room work. This left seven old milling machines which could be assigned to this work and which were accordingly tooled up. The seven machines were given to

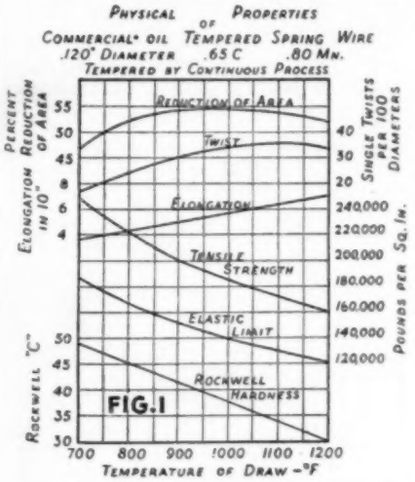
the three men to run. Piece rates were not changed. Any man could load any machine that he saw idle. The only thing impressed on their minds was to keep the machines going. Earnings were pooled and divided pro-rata.

It worked fine until the wood-working plant became well supplied with tools, when there was a kick coming. No man could make day wages, so it was up to two of them to be assigned to other work. One of the men took care of the job, running three and some times four machines at one time, loading only and at times working on four different cutters, and at times filing off burrs. There is no reason why the method can't be applied anywhere. —C. G. Williams.

American Machinist
Reference Book Sheet

Heat-Treatment of Springs

SPRINGS made from annealed wire must be hardened and tempered after forming. A hardening temperature of 1450-1550 deg. F., and a tempering temperature from 700-900 deg. F., depending upon the properties desired, are commonly used for a 0.60 carbon spring steel. Almost invariably quenching is done in oil for both continuous tempering of wire and for springs or forms. Long soaking time at either the hardening or drawing temperatures has not been found necessary for simple carbon spring steels. Alloys, such as chrome vanadium, require more time and care. Fig. 1 shows the variation in physical properties, with different drawing temperatures, that may be expected in commercial oil-tempered wire run under commerical conditions.

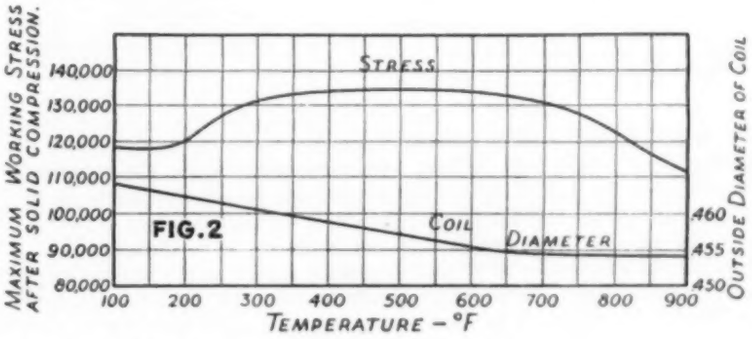


Relatively high tempering temperatures of either wire or coiled springs produce wire with relatively low tensile strength and Rockwell hardness. In general, it has been found that the softer the wire in a spring the longer will be the fatigue life, when the spring is subjected to rapid and continued deflection. This is the reverse of a conclusion commonly accepted that the life is longer with higher tensile strength material. Most springs are operated well above the endurance limit, and data applying to endurance limit may not necessarily lead to the same conclusions for relatively higher stresses. Furthermore, a great many springs set slightly in operation before final fracture occurs, thus operating at a lower stress. In the case of softer wire, the set of a spring and the consequent decrease of working stress occurs more readily than with harder wire. In practical application, many springs could set ten per cent or even more and continue to operate a mechanism. Under certain conditions, this ten per cent decrease in working stress might double the fatigue life of the spring.

Hardening or tempering of a spring should not be confused with a low-temperature heat-treatment after coiling, which is actually a low temperature anneal for the purpose of relieving internal stresses within the wire itself due to the cold work performed in coiling. It is not necessary to apply this treatment to springs wound from annealed wire, but it may be applied both to springs wound from tempered wire and from hard-drawn wire. Its effect is much more marked on hard-drawn wire, including music wire. This anneal may actually increase the elastic limit of the wire in the spring and increases its resistance to deformation when in operation. For example, compression springs which take a permanent set if compressed immediately after coiling may show no set after proper low-temperature annealing. A temperature of 500-550 deg. F., for a sufficient time to allow the wire to become thoroughly heated will produce satisfactory results.

In the case of extension springs, the initial tension is decreased by practically any temperature of anneal. Extension springs are therefore baked at a lower temperature or purposely wound with excess initial tension because it will be decreased by the correct amount during the baking operation. Also in the case of extension springs it is preferable that they are not baked previous to final forming of the ends. Fig. 2 illustrates the effect of low temperatures in increasing the working stress of a spring.

The settage of a spring when operated at temperatures above normal is a separate problem compared with the effect of heating a spring before compressing, with subsequent operation at normal temperatures, as illustrated in Fig. 2. A spring with set completely removed at normal temperatures will show a marked decrease in strength with increase in temperature, if loaded and subjected to heat at the same time. At 500-550 deg. F., for example, an ordinary carbon-steel spring will lose a major part of its strength when fully compressed. Tempered wire springs that have been finished at 800 deg. F. will set under the above conditions in almost exactly the same manner as hard-drawn wire springs.



Courtesy of the Wickwire Spencer Steel Co.

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• IDEAS FROM PRACTICAL MEN

Designing Dies for Structural Strength and Efficiency

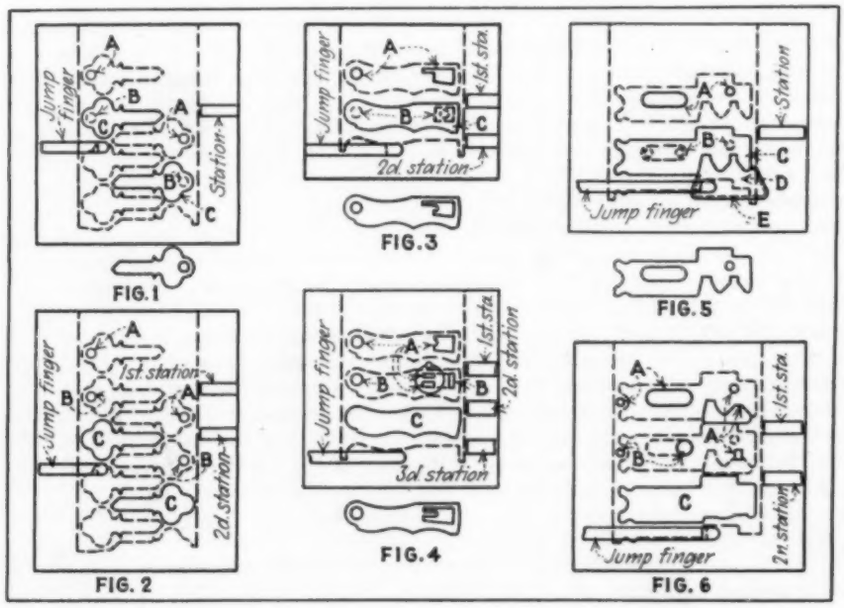
CHARLES F. KRAUT

In actual practice I have known of piercing and blanking dies where, due to structural weakness, the cost of repairs and the replacement of parts has exceeded the original cost of the tools before 100,000 blanks were produced. Some examples of such dies, and the dies that were made to replace them are shown in the accompanying illustration.

The layout for a die for keys of german silver, 0.088 in. thick, is given in Fig. 1. The piercing holes are shown at *A*, while at *B* are indicated the locations of the pilots in the blanking punches (not shown) and at *C* are the blanking holes. The punches were constantly breaking and splitting around the pilot holes, necessitating frequent grinding, rendering them prematurely useless. In Fig. 2 is shown the layout of a die that was made to replace the one shown in Fig. 1. The piercing holes are at *A*, the leader holes in the die are at *B* and the blanking holes are at *C*. The leader pins (not shown) are supported by bushings in the stripper. Since the leader pins control the stock, the pilots have been eliminated and the blank-punches now being solid, they no longer break, producing several million blanks.

The layout of a worn-out die that came to my attention for replacement is shown in Fig. 3. At *A* are the piercing holes; at *B* the locations of the pilots; and at *C* is the blanking hole. At the bottom is shown one of the blanks from this die. One of the piercings is incomplete, being completed in a costly second operation. In Fig. 4 is shown the layout of a die that was made to replace the die in Fig. 3, and in which the piece shown below was produced complete, eliminating the necessity for a second operation. The piercing holes are at *A*, the leader-pin holes at *B*, while at *C* is the blanking hole.

In the layout in Fig. 5, *A* indicates the piercing holes, *B* the locations of the pilots and *C* the blanking hole, while *D* indicates the conventional inserted piece (in toolmakers' parlance generally referred to as a "dutchman") usually employed when heavy stock is used and where the blank has projections. If the die were made solid, the counter projections in the die would be likely to break in service, resulting either in the loss of the die or in costly repairs. The dotted line at *E* shows the outline of the base of the insert, it having a taper of 1½ deg. on each side for a dovetail drive fit. It is obvious that the dovetailed insert, too, is apt to break frequently, requiring expensive replacements. In the solid die shown in Fig. 6, the expensive "dutchman" has been dispensed with. *A* indicates the piercing holes, *B* the leader-pin holes, and *C* the blanking hole minus the projections. The piercing operations shown at *A* in the first and second stations have previously trimmed the outline of this portion of the product prior to its being blanked.

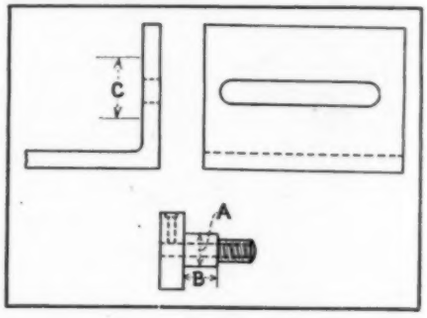


Universal Gage for Center Distances

GEORGE BELBES

The device illustrated is admirably adapted for toolrooms, inspection departments and jobbing shops for checking the center distances of holes in work, the output of which is not large enough to warrant the making of expensive inspection gages.

The gage consists of an angle plate of suitable size in which a slot is milled horizontally and accurately parallel with the base, and a number of adapter bushings, such as the one shown at *A*, the bushings being a gage fit in the slot in the angle plate. Plugs of a size of the holes to be gaged are inserted in the bushings and are held by setscrews. The dimension *B* is approximately 1/8 in. less than the thickness of the angle plate to insure clamping. Having inserted the plugs in the bushings, the bushings are set in the angle-plate slot, lightly clamped and adjusted to the required center distance by a micrometer. They are then clamped tightly. To secure a flat surface for clamping, the metal surrounding the slot at the back of the angle plate, as at *C*, may be machined.

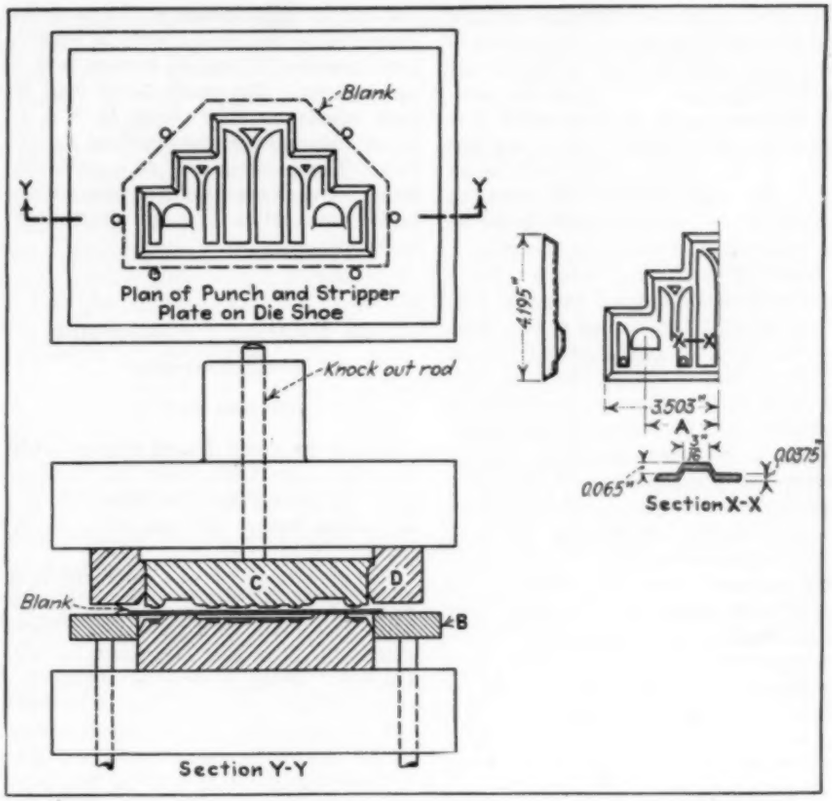


Press Tools for Escutcheon Plates

C. W. HINMAN

Chief Tool Designer
Kobzy Tool Company

In Fig. 1 is shown a set of press tools for forming and coining escutcheon plates for burial caskets, one-half of one of the plates being shown at *A*. The tools are of the inverted type, the die being above



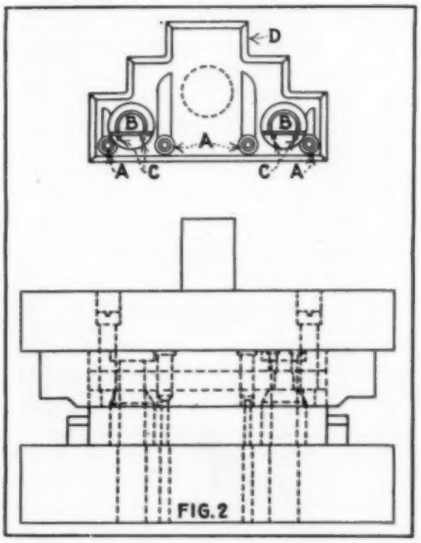


FIG. 2

and the punch below. The stripper pad *B*, upon which the blank is located in a nest of pins, is operated by heavy springs under a plate (not shown) beneath the die-shoe. The drawing and coining die *C* slides within the outer drawing and forming die *D*. It is backed by stiff coil springs and is operated by a knockout rod passing through the punch-holder shank.

A pressure of 150 tons is required to do the work. This apparently excessive pressure is necessary in coining the sharp corners at the edges of the raised portions of the work, a section of which is shown at *X-X*. It will be observed in this section that the metal is squeezed thinner on the sides of the raised portions, from which metal was obtained for raising the sharp corners. The twelve right-angled, beveled corners in the outline are drawn, the straight sides between the corners being formed.

In the following operation, the tools for which are shown in Fig. 2, the outside of the work is trimmed to size and the four screw holes *A* are pierced and embossed for flat-head screws. Also, the two semicircular slots *B* and the four rectangular holes *C* are pierced for the attachment of the handles. Three scrap cutters at *D* sever the band of scrap trimmed from the outside of the plate. 50,000 of the escutcheon plates, representing 5,000 caskets, are used annually by one firm, which might suggest that there is no depression in some lines of manufacture.

While the layout for the tools described was a nice and unusual piece of work, I did not enjoy it on account of the burial-casket idea involved. I smelled "funeral flowers" all the time.

Holding Glass With Rubber Heels

FRANK W. BENTLEY, JR.

When cutting and fitting small round or circular pieces of glass, one does not always have the best of luck with the cutter, and it is a usual practice to smooth and finish the outside on the grindstone or other abrasive wheel. Holding the pieces of glass is not an easy or at times a safe procedure for the fingers. I use two inexpensive soft rubber heels as shown, one on each side of the glass. They afford a good, safe grip; especially if the glass should break, as it frequently does. You can also hold them so as to see just what you are doing all the time.

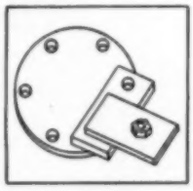
Tools for Transferring Holes
Discussion

WM. BRYCE

Tinsley, Sheffield, England

The value of such tools as were described by George Siegrist in an article under the title given above (*AM*—Vol. 76, page 650) does not appeal to me for the following reasons: First, it is questionable whether or not they have any advantage in regard to speed; and second, however accurately the holes are marked, it does not at all insure their being accurately located, because all such efforts are invariably nullified by the runout of the drill. The vital thing for securing accuracy is to take preventive measures against the runout of the drill. If this can be done then scribed circles are quite adequate when no jig exists.

Much general work has to be marked and drilled accurately, and it presents no difficulty if one of the many correct methods is adopted. My method is to use a small plate in which a hole is drilled to the same diameter as that of the scribed circles, and of the necessary thickness to guide the drill. After adjusting the plate on the work until the



hole coincides with the scribed circle, it is securely clamped. The plate serves as an improvised jig, and by spot drilling the location of the hole through it, the result is very satisfactory. Where but few holes are to be transferred, hardening the plate is not essential. The sketch shows the scheme.

Press Tools for Welded Can Bottoms

GEORGE J. MURDOCK
Murdock Research Laboratory

The problem presented was the design and construction of press tools for producing the bottom of a rectangular-shaped can that was too deep to be drawn. The sides of the can were of one piece blanked-steel stock, 0.020 in. thick, that had been folded around a mandrel and the seam torch welded. As the stock was so thin, it was necessary to have the lips of the flange on the can bottom not only sharp, but presenting an area to be fused substantially the same as the thickness of the sides. It would have been an easy matter to draw the bottoms and to blank them at one operation if the sides of the flange to be welded to the shell could have been left flat and without sharp edges at the top, but if this had been attempted two more operations seemed necessary and these it was desirable to avoid.

To do the work at one stroke of the press, the tools illustrated below were constructed and proved to be satisfactory. The three essential dies were cut in the plate *A*. The layout of the punches is shown in plan and side view on the punch plate *B*. Punch *C* acts at the first stroke of the press and pierces the drawing relief. The stock is then advanced so that the hole thus pierced is let over the stop pin *D*, in progressive die fashion, while the next stroke causes the drawing punch *F* to push the stock into the drawing die *H*, from which it is ejected by the knockout *I* on the upstroke of the press. The next move brings the depression in the work to where it drops into the blanking die *K*, and where it is centered by the pilot *L* on punch *M*, while the blanking is being done, so that thereafter a complete bottom is made at each stroke of the press. The design of the pilot *L* was the most important part of the job, for if it were too large it would cause the blanking punch to cut the sides of the flange bearing on the casing too long, that is, longer than the thickness of the stock.

If, on the other hand, the pilot were too small, it would cause a flat line to be left where a sharp edge was desired to make a smooth job after welding. To prevent the bottom of the weld from being "spotty," a clearance of 0.003 in. was required so that as the metal fused slightly more in some places than in others, the surplus could run down from the melted edge *A*, at top, into the clearance between the flat edge of the flange at *B* and the casing *C*, thus producing a uniform weld at *A*, while at the same time acting to stiffen the union.

Press Tools for Making Square Tubing

WILLIAM ANDERSON

The tools illustrated are for forming square tubing, as at *A*, in comparatively short lengths. The blank is placed on the die in the first-operation tools, left, as indicated by the heavy black lines.

These tools form the blank to the shape shown at *B*, right. In the second-operation tools shown, the partially formed blank is closed about the square, loose mandrel *C* and is formed into a square tube. The same die is used in both operations, the pieces *D*, Fig. 1, being removed for the finishing operation. The punches are, of course, different for each operation. A loop handle in the mandrel at *F* is for convenience in handling.

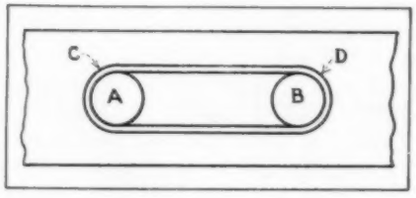
An Endless Leather Belt —*Discussion*

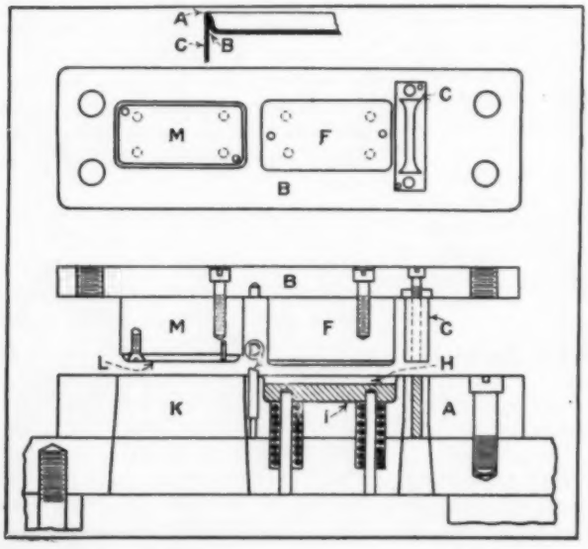
CHARLES KUGLER

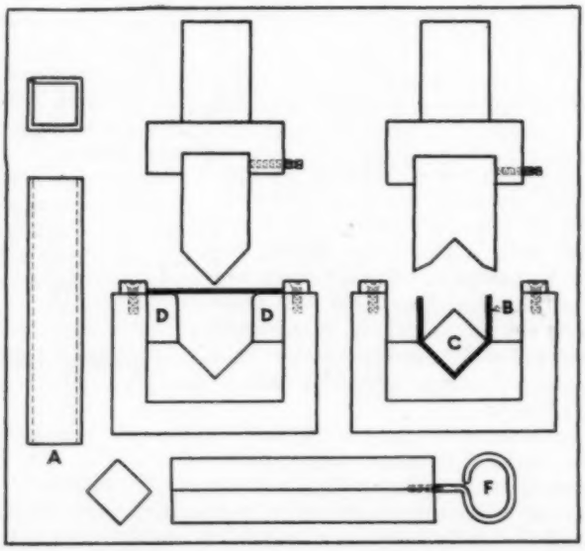
In the Seen and Heard column (*AM* Vol. 76, page 624), John R. Godfrey gives an interesting description of how an endless leather belt was made in one plant.

Some years ago I was employed in a large plant in which endless leather belts were made in a way that differed materially from that described by Mr. Godfrey. From a piece of old belting of the proper width, the endless belt was cut out according to the layout shown in the sketch A washer cutter was held in a carpenter's brace and the two holes *A* and *B* were cut. Then the two 180-deg. cuts *C* and *D* were made, after which the straight part was cut out with a knife. These cuts left the belt square in section and rounded at the ends. We kept away from the edges of the belt.

The belt was then placed on the pul-







leys in the machine in which it was to be used and the machine was started. With a piece of glass, the corners of the running belt were scraped until it was round in section. By this method the sharp corners did not have to be hammered down, nor was it necessary to draw the belt through a die to make it round, as in the case of the belt Mr. Godfrey told about. Since the belt was made from a piece of old belting that had all the stretch taken out of it by use, it was made the required length and needed no stretching.

A Floating Base

H. R. HAGEMAN

Difficulty is often experienced in drilling deep holes of small diameter, due to deflection of the drill caused by the work not being correctly aligned with the drill spindle. This difficulty can be largely overcome by placing the work on a plate mounted on three balls, thus providing a three-point floating bearing. Such a plate is shown in Fig. 1. In the sectional view, two methods of applying the balls are shown.

As will readily be seen, the friction being reduced to the minimum, it is possible for the drill to slide the base in any direction and automatically to bring the work into alignment with the spindle.

A surface gage, a height gage, or a scribe block clamped on the floating base can be easily moved on the surface plate upon which the work is mounted. In scribing lines, the ease and uniformity with which the floating base can be moved will prevent the lines from being wavy.

Obviously, the floating base can not be used successfully on a planer table, or on a similar surface having T-slots and other openings. For such use it would be well to machine two channels in the base of the gage, as shown at *A*, Fig. 2, and to equip each channel with a row of balls held in place by a retainer, as at *B*, The retainers should be a press fit in the channels. It is, of course, necessary that both channels be accurately in the same plane.

Adjustable Auxiliary Jaws for a Chuck

J. DECKER

Mechanical Engineer, U. S. Rubber Company

Having to bore a variety of tapered castings, a typical one being indicated at *A*, made it necessary to design adjustable auxiliary jaws for the chuck to accommodate the different tapers.

The chuck jaws were annealed and pockets were milled in them to receive the auxiliary jaws *B*, which are of the same general shape as that of Woodruff keys, but very much thicker. Two of the auxiliary jaws have teeth cut in their semicircular parts, making them virtually segments of wormwheels, and two of the regular jaws are equipped with worms *C* that mesh in the teeth in the auxiliary jaws. All the auxiliary jaws bear against the bottoms of the pockets in the regular jaws. They have circular V-grooves *D* milled in their sides and are held in place by pointed screws engaging in these grooves. V-grooves are cut in the flat faces of the auxiliary jaws, so that the gripping surface will be tangent to the work, and these grooves are serrated to prevent the work from slipping.

In adjusting the auxiliary jaws to a certain taper, the pointed screws are loosened and a master taper-plug is put in the chuck. Then the two worm-controlled jaws are adjusted to the taper plug by turning the worms, the third jaw floating freely in its pocket. The pointed screws are then tightened to lock the two worm-controlled jaws. The third jaw is held by its pointed screw tightly enough only to keep it from falling out of its pocket. The auxiliary jaws, the worms, and the pointed screws are heat-treated in accordance with the imposed strains and wear. The pointed screws are located on the sides opposite the ones taking the thrust of the cut.

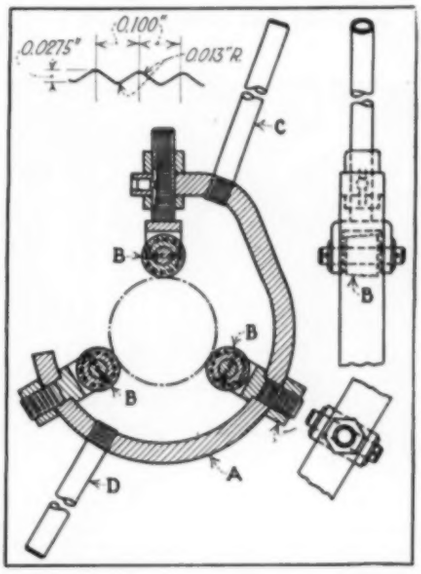
Tool for Corrugating Sheet Metal

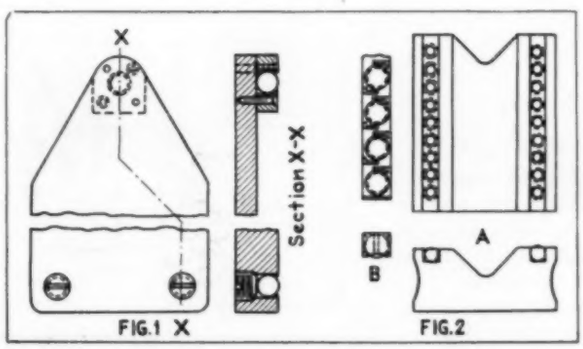
I. BERNARD BLACK

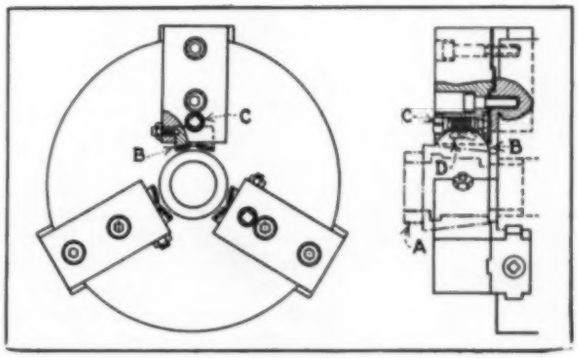
It was necessary to corrugate some 6½x48-in. sheets of 0.010-in. stock in order to provide a protective cover for some experimental work. Since we had no means for doing the work, we designed the tool illustrated.

A wooden mandrel was made of the correct diameter for the sheets to be wrapped around it and was held on centers in the lathe. Referring to the illustration, the roll-holder bracket *A* is a simple forging in which the two lower roll-holders are firmly held by nuts. The roll-holder at the top is adjustable toward or from the center, as indicated. The rollers *B* are tapered and have shallow threads of wide angle, as shown greatly enlarged at the top of the illustration.

With a sheet wrapped around the mandrel and clamped in the center and at the far end, the rolling fixture was slowly moved around the mandrel by hand. The lathe was not running, in order that the corrugations could be properly started. When the rollers ap-







proached the center of the sheet the clamps were removed, as by that time the material hugged the mandrel closely, due to the ironing action of the rollers. The lathe was then started and the work was finished by power.

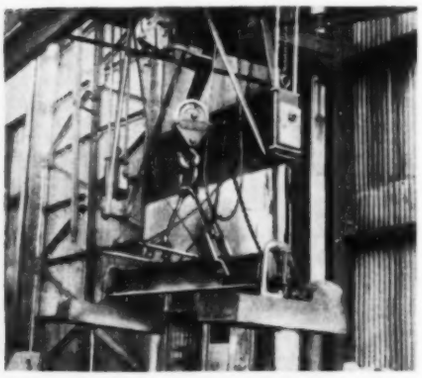
In order to have the corrugations in a continuous helix, plenty of side play was allowed the rollers in their holders. Two handles, *C* and *D*, were used to operate the device. Up to this writing, quite a number of sheets have been corrugated without apparent wear on the rollers, which were made of S.A.E. 1020 steel F.A.O. and were not even hardened.

Balancing Device for Hoist

W. J. TANGERMAN
Shop Superintendent,
Union Metal Products Co.

As one step in the manufacture of corrugated ends for freight cars, the unformed plates, approximately 6x8 ft., must be placed singly on the starting end of a furnace conveying device. Since the plates are carried in by crane in stacks of 20 or 25 plates, the separating and placing can best be done by lifting the plates singly with a magnet.

We found that a magnet used in the



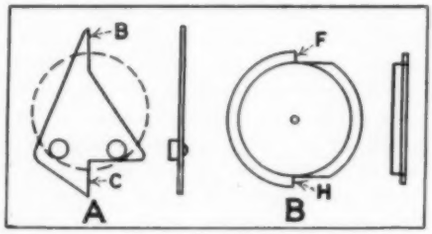
center of the sheet would permit too much sag, and also, if strong enough to lift the plate, would also lift the plate beneath it. Further, it permitted no control of the swaying plate. Consequently, we formed a hoisting rig of a section of I-beam, lifted by links engaged by the hook of a Shepard hoist and carrying a magnet at each end, as in the illustration. While this set-up handled the plates as we wished any motion of the hoist upon its track caused the magnets to sway and swing. The side chains and counterweights were put on as indicated, extending from outriggers at the center of the beam over pulleys on the hoist carriage just below the rail, then down to the counterweights. These counterweights run on bars extending vertically downward from the carriage, and serve effectively to keep the carriage and magnets lined up and also to kill any tendency to sway.

To Set Off the Center Line of a Bore—*Discussion*

T. C. TAYLOR
Yardley, Birmingham, England

The method described by D. Q. Dunstone in an article under the title given above (*AM*—Vol. 76, page 766) is, I think, open to inaccuracy by the careless placing of the templet. If. Mr. Dunstone will use either of the templets illustrated, I venture to say that he will find them simple, foolproof and accurate enough for the ordinary run of jobs.

At *A* is a templet cut to the outline shown and having two short studs attached. The surfaces *B* and *C* are on a line at a right angle to a line passing



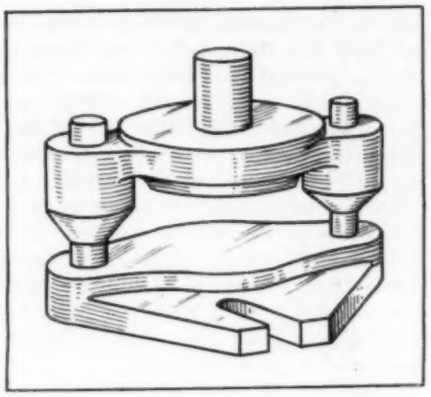
through the centers of the studs. With the templet laid on the work with the studs in the bore and pressed tightly against the wall, lines scribed from surfaces *B* and *C* will be extensions of a line through the center of the bore. This templet is universal and is, in principle, a reversal of the well-known center square.

The templet at *B* is a thick plate turned to fit the bore, leaving a flange that is notched as shown. The notches are cut so that the surfaces *F* and *H* are on a line passing through the center. Lines scribed from these surfaces will be extensions of a line through the center of the bore. This templet is, of course, not universal, but must be made to fit the bore from which the center line is to be set off.

A Safer Die Set

JOHN J. MC HENRY

It is my belief that press operators in small shops run considerably greater risks of injury than do those in large plants. In large plants, with presses equipped with roll-, hopper- and dial-feeds, a feeling of security from injury is created among the operators. But the



small plants can rarely afford such devices.

As an aid to safety for the operator, specially in small plants, die-sets made as illustrated are worth the extra trouble. The bosses on the punch-holders are beveled on the under sides, as shown. Should the operator get his fingers under them, the bevels would push his fingers away and out of the danger zone as the ram descended, and no injury would result.

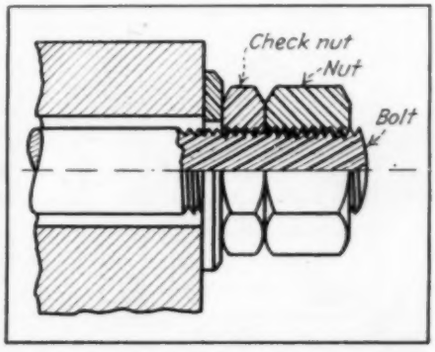
As a matter of safety to the tools themselves, one guide pin should be made larger than the other. This construction would prevent the tools from being assembled the wrong way about.

The Correct Position of Check Nuts

EMIL WITTMANN

Where the nuts of braces, bolts, or screws are prevented from turning by the application of a check nut, the check nut is frequently but erroneously placed on top of the nut. It should be placed against the tieplate, or supporting member, with the regular nut on top of it, as shown in the illustration. In the section is shown, in extreme, what takes place after the check nut and the regular nut have been drawn tight.

The thread flanks of the regular nut toward the supporting member are the supporting flanks, and the opposite



flanks have clearance. The thread flanks of the check nut toward the regular nut are the supporting flanks, and the opposite flanks have clearance. The regular nut takes up both the load and the additional load arising from drawing it up on the check nut, while the check nut takes up only the additional load referred to. It is against all principles to have the check nut take up both loads, which will be the condition when the regular nut is erroneously placed against the supporting member.

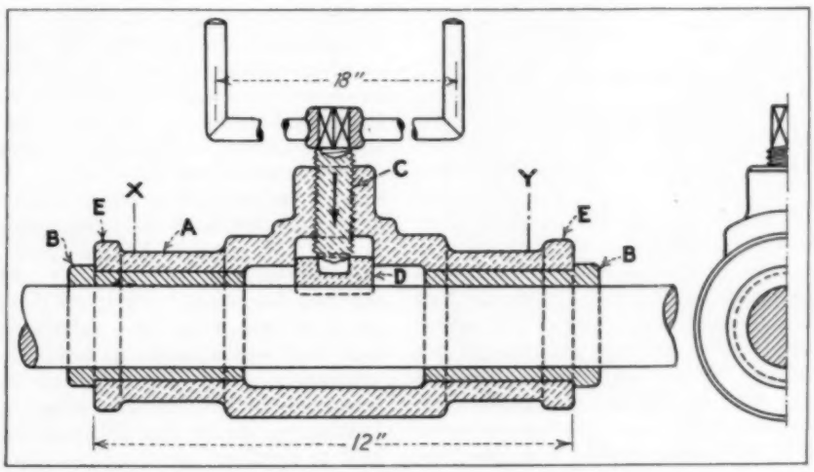
Straightening Work in the Lathe—*Discussion*

J. T. TOWLSON
London, England

The device described by Charles Kugler under the title given above (*AM*—Vol. 76, page 212) does not attract me so far as to lead me to advise its adoption. My principal objection to it is that the shaft being straightened must be removed from the centers and lowered to the straightener for operation, then back to the centers, and if not straight, down into the straightener again; and so on back and forth.

As all practical lathe hands know, such lifting in and out of the centers is the most objectionable part of the work. It reminds me of the days when work to be straightened was taken from the lathe to the anvil, blocked up, protected by a piece of copper and struck with a sledge. On account of the labor involved, that method was long ago abandoned in favor of the "Jim Crow." This device was carried by tackle that traversed a girder over the lathe. It was made so that the parts the shaft rested upon could be adjusted to suit a long or a short bend.

What may be termed a glorified "Jim Crow" is illustrated. It is my idea of a useful type of straightener and has become a standard device for straightening shafts from 1 to 3½ in. in diameter. The body *A* is a semi-steel casting. Steel bushings *B* can be slid in or out of the body and are an easy fit on the shaft to be straightened, *C* is the forcing screw and *D* is a soft pressure-pad. Long or short bends can be dealt with by sliding out the bushings to the points *X* and *Y*, or leaving them as shown. Of course, bushings must be made for each size of shaft to be straightened. It will be understood that the "Jim Crow" remains upon the shaft and that the shaft is not removed from the centers throughout the operation, as it can be revolved in the bushings while marking the bend.



Cam Milling Attachment for the Lathe

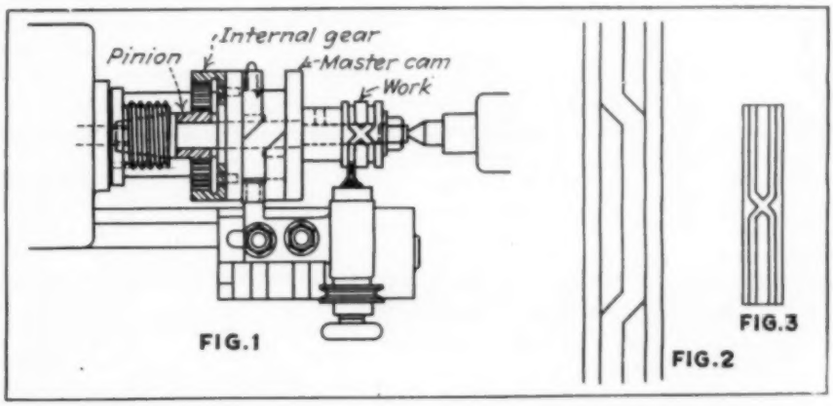
ANDREW BEUSCH

We had to mill several hundred drum cams of brass, 2¼ in. in diameter and 1½ in. in width. The races were ¼ in. wide and ⅛ in. deep, crossing each other in both directions at an angle of 45 deg. Since we had no machine for this work, we designed the attachment illustrated in Fig. 1 for use on a small lathe.

Both the master cam and the work were carried on a mandrel, one end of which was tapered to fit the taper hole in the lathe spindle. The work was clamped against a shoulder on the mandrel, but the master cam was free to revolve. The master cam was mounted on a faceplate having an internal gear. A pinion keyed to the mandrel and an intermediate gear (not shown) mounted on a stud attached to a stationary part of the lathe and meshing with the internal gear and the pinion, constituted the drive for the master cam. The gears were so proportioned that the master cam made one revolution to two of the work, but in the opposite direction.

On the toolblock was mounted a milling attachment driven from the countershaft, also a bracket carrying the cam roller for the master cam. The development of the master cam is shown in Fig. 2, the angular parts of the race being diametrically opposite each other. Since the master cam made but one revolution to two of the work and the angular parts of the race were diametrically opposite, the races in the work crossed each other in both directions at the same place.

The requirements of the work called for sharp interior corners where the races



crossed, as indicated in Fig. 3. If no provision had been made to make these corners sharp, the travel of the roller around the corners of the race in the master cam would have left them slightly rounded. To make the corners sharp, spring plungers were put in corresponding corners of the angular parts of the race in the master cam. The plungers were so beveled as to lengthen the angular parts of the race and thus force the roller against the opposite side of the race before entering and leaving the angular part, causing it to change its direction abruptly.

In operation, the longitudinal feeding mechanism was disengaged, so that the movements of the carriage were con-

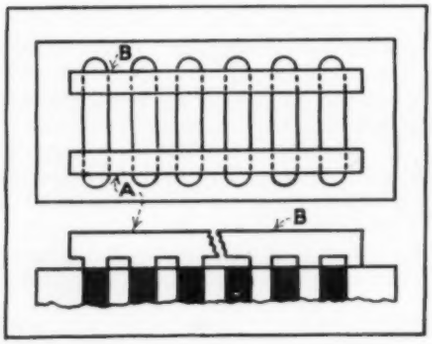
trolled by the master cam. The cross feed was, of course, used to feed the cutter into the races of the work, the depth being controlled by a stop.

Parallels for Magnetic Chucks

W. T. SOVITSKY

Many grinding jobs, where the work is mounted on a magnetic chuck, are of such a nature that parallels are required under the work. If ordinary parallels are used, the magnetic current will be absorbed by them and will not pass through the work. Thus the work will not be magnetized. This difficulty can be overcome by making the parallels as shown in the illustration.

Parallel *A* is notched so that its legs rest upon the chuck in contact with one



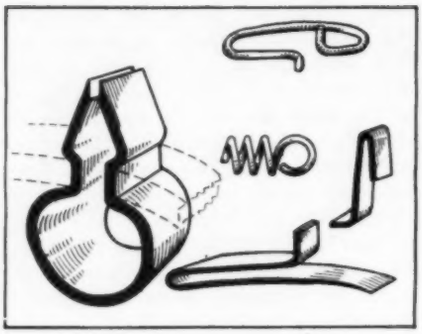
pole of the magnet, while parallel *B* is so notched that its legs rest upon the chuck in contact with the opposite pole. By this arrangement, the magnetic current flows from the chuck through one parallel to the work, through the work to the other parallel, and through it back to the chuck, thus permitting an uninterrupted flow through the work, magnetizing it and holding it securely.

Auxiliary Jaws for the Vise

G. A. LUERS

The utility of the auxiliary jaws illustrated will be apparent to anyone familiar with the difficulty of holding small parts and various wires for making sharp bends, for forming hooks on the ends of helical springs, or for filing the edges of work to a bevel. Some of the work that can be done by the aid of these jaws is indicated in the illustration.

To make the jaws, a flat steel plate is heated and bent to the shape shown, having shoulders to rest on the regular jaws. The auxiliary jaws can, of course, be of any width up to that of the regular jaws. The upper parts of the jaws should be hardened.



SEEN AND HEARD

JOHN R. GODFREY

432,000,000 Starts and Stops

Few of us who see moving pictures appreciate the mechanism involved or the accuracy required. We know that the film starts and stops 16 times a second, receiving an exposure at each stop and moving the height of the picture between the exposures. And these starts and stops must be positive, accurately timed, and not conducive of excessive wear. How well this is accomplished is indicated in the recent report of a camera that had "pulled" 24,000,000 feet of film, which means approximately 432,000,000 starts and stops. This camera was recently examined and is said to have shown no appreciable wear.

Allowing for Oil Film in Bearings

Scraping bearings to a special mandrel is common practice. It helps in securing uniform bearings and in aligning two or more bearings for a given shaft. These mandrels are usually made of the same diameter as the shaft that is to run in the bearings. One shop building a special type of machine uses a mandrel enough greater in diameter than the shaft to be used to allow for the desired oil film, which seems to have its advantages.

Cast-Iron in the Shop

Cast-iron is perhaps our most useful metal, all things considered. And yet it is losing ground in many places where it formerly held supreme sway. Recently, a foundry salesman was trying to drum up trade in a fair-sized machine shop. He was told they used little cast-iron but could hardly credit it, so the boss took him out in the shop. To his surprise and chagrin he only found two castings in the shop, and those were parts that had been welded into a plate steel frame for a new machine to secure a better bearing surface than the steel afforded. There are probably some cases where cast-iron could come back as a material if the foundry will produce castings true to pattern and not overweight. But foundrymen must get the modern idea of castings, for the days when they could say "take it or leave it" have gone.

Improving Replacement Parts

The making of replacement parts for automobiles has long formed the basis for many small businesses. And though makers warn against "pirate" and "gyp" parts and always urge the purchase of "standards" from the factory, a great business has been done in such parts and many have given good service. News comes of similar work in connection with textile machinery. Many small parts that wear out are not replaced from makers' parts but by special parts, frequently altered by the mill mechanic to give better service in his mill. A bright mechanic is building up quite a business in this line, by supplying improved devices to take the place of standard parts.

Chrome Plate Prevents Sticking

New uses for known materials and processes keep cropping up continually. This time it is the chrome-plating of two parts of a special shaft that are splined together. Before the splines were plated with chromium it was frequently difficult to get the two pieces apart when overhaul became necessary. The chromium plate has a slight slipperiness about it that prevents the parts sticking together. It is also possible that the hardness of the plate prevents the steel from bedding itself to the other piece. At any rate it works—and may have other similar applications.

Utilizing Waste Heat

Getting something for nothing usually has a catch in it, whether it be perpetual motion or dabbling in Wall Street. But we can frequently apply the old "penny saved is a penny earned" idea and get away with it. A recent case was in a forge plant where the manager, who is also an engineer, had installed a method of taking waste heat from his annealing furnace and using it to make steam for his pickling baths. Being a bit skeptical I asked how much he had increased his fuel bill on the furnace. But unless someone has slipped a cog in keeping track of fuel costs he's really saving heat that was a total loss before. As preventing waste is one of the real economies in manufacture, it pays to keep an eye on the fuel bills and utilize heat to the limit.

SHOP EQUIPMENT NEWS

The Acme-Graybar Chronolog

Time study is only as good as the observer, and it is expensive. To supply management with most of the facts recorded in time studies, inexpensively and mechanically, the "Chronolog" was developed. It is built by the National Acme Co., Cleveland, Ohio, and is distributed and serviced by the Graybar Electric Co., through its various branches.

The Chronolog was invented by a former screw machine product department superintendent who was dissatisfied with the information obtainable on the machines in his department, and was further refined by the Graybar engineering staff. As indicated in Fig. 1, the instrument is a compact unit which can be applied to a production machine mounted on its own pedestal or attached to brackets on the machine.

Two interlocking oscillating switches, shown connected by flexible conduit in Fig. 1, actuate the recording mechanism in the case. They are made interlocking to prevent falsifying of the record by operating the trip mechanism by hand. The left hand switch in the illustration is operated by the upper end of the cam follower bellcrank, while the other switch is tripped by the finished piece as it drops from the machine. Neither switch alone will operate the mechanism. Standard switches of several types are supplied but their application to an individual machine may well demand considerable ingenuity on the part of the installation engineer.

Inside the case is a paper roll on which is printed a record of the machine performance. The end of one of these records appears in Fig. 2.

One function of the machine is to record the number of pieces produced. The switch mechanism does this and the record is printed in the right hand column, Fig. 2.

The other function of the Chronolog is to record the active and idle time of the machine, and the reasons for idle time. For the purposes of this record the instrument prints clock times in the third column. While the machine is producing regularly entries are made every 5, 10, 15 or 30 min. depending on the way it is set. The record of Fig. 2 is on a 5-min. basis. In the fifth column it prints cumulative idle time, and in the sixth cumulative production time, both in minutes. Thus, at 5.25 P.M., 1,574 completed parts had been made and the machine had been busy for 444 min., idle for 205 min.

But there is also a record of the reasons for the idle minutes. The fourth column is reserved for symbols which are explained in the summary at the bottom of Fig. 2. At 5.25 P.M. the operator shut down his machine for 2 min. because of lack of stock, Symbol E.

The telephone-type dial on the front of the instrument case, Fig. 1, is used to record the symbols on the record. When he shuts down his machine for any purpose the operator simply dials the proper symbol which is then printed on the record. When he resumes production the dial automatically resets itself to P, except from position S which is "set-up." As soon as perfect pieces are produced after setting-up the operator pushes his reset button, below and to the left of the dial, and the dial returns to P.

To the left of the reset button is the holder for the dial symbol card. Above this card are two bull's-eyes. As long as current is on, the upper one is lighted. The lower one lights when the instrument is recording. Below the card is a button for setting the clock to correct time.

Above the two small signal lights is the operator's switch. When the operator arrives at the machine he inserts his key (the top of it appears just above the small glass dome) and turns the switch to "on." His number is then printed in column 2. To the left of his keyhole is another one in which inspectors, foreman, or anyone else having anything to do with the machine insert their respective keys while they are at the machine. The instrument records their key numbers (Col. 1), and the idle minutes column tells how long they were there. When the operator removes his key as he leaves for the night the instrument records the time.

Inside the glass dome is a light that burns when the machine is idle. If the machine turns over without producing work the light flashes, thus warning operator and foreman that attention is needed.

To the right of the operator's switch

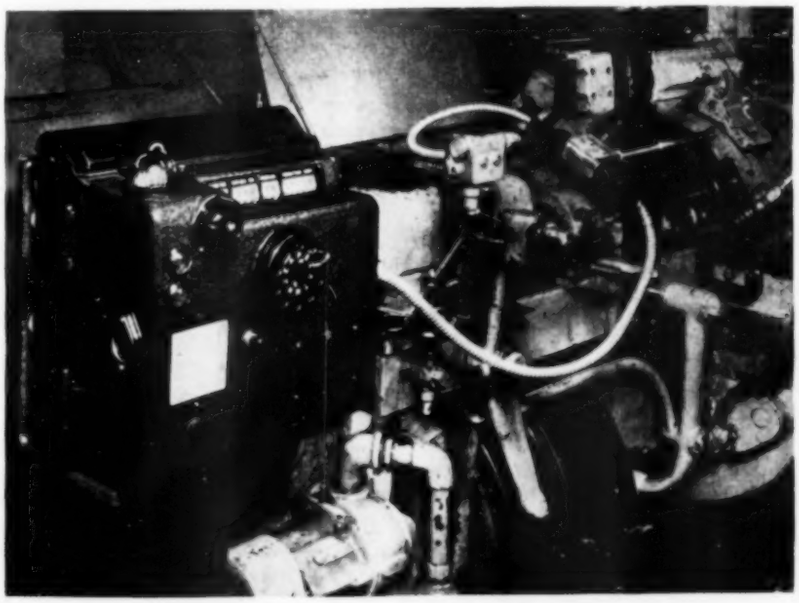


Fig. 1—Chronolog installed on automatic chucking machine showing interlocking oscillating switches

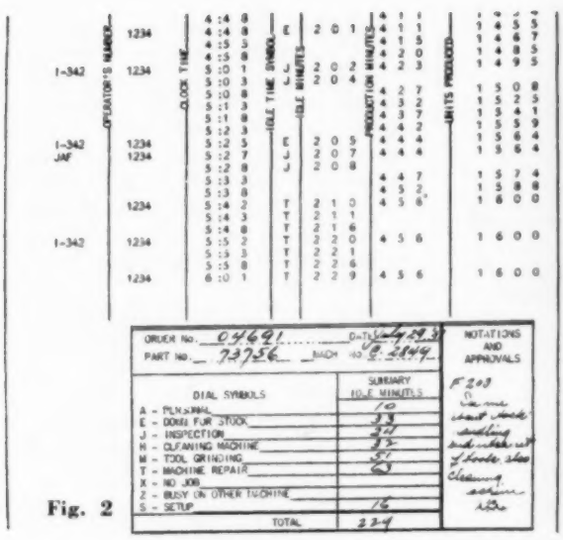


Fig. 2

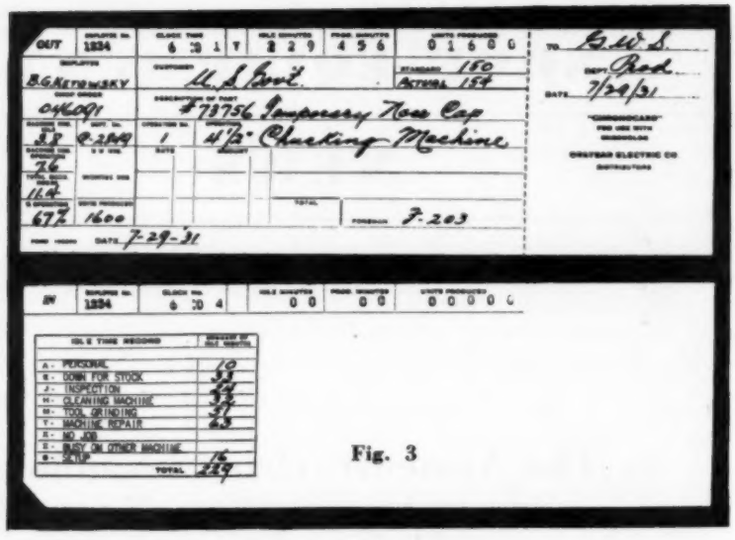


Fig. 3

Fig. 2—Chronorecord evidence of what happened near the end of a production run. Fig. 3—Chronocard summary of the data on the Chronorecord

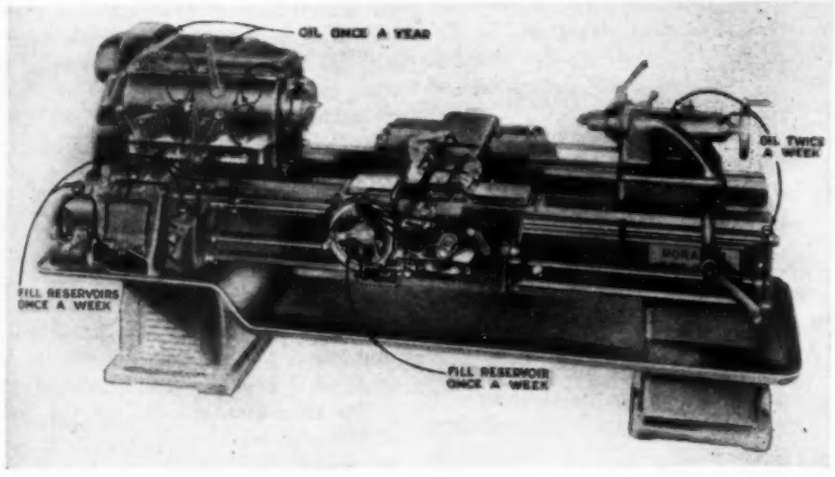
are windows which give the same readings that are printed on the chart, thus giving the operator a constantly visible record of his output at any time. The cover at the back of the top of the case is hinged so that a foreman can throw it back and make pencil notes on the chart. A slot at the right hand side of the case permits insertion of a card on which the machine will print the last line of the record when a lever is touched. This gives a production record for the production department at any time.

The summary on the "Chronocard," Fig. 3, is drawn off the "Chronorecord," Fig. 2, by clerks in the production department. Duplicates may be sent to other interested departments.

One Chronolog may be used on more than one production machine, being shifted about as low production indicates that a particular machine needs attention. It operates on 110-volt, 60-cycle current.

Monarch Lathes with Automatic Force-Feed Lubrication

The Monarch Machine Tool Co., Sidney, Ohio, has announced that automatic force-feed lubrication for the bed, carriage, apron and compound rest is now standard equipment on all its lathes. The lathes have only 14 places that need occasional lubrication—two of them require oil once a year; five require oil once a week, and seven require oil two times a week. All major units are oiled by centralized lubrication systems. No oil cups appear on the front of the apron. The oil sump can be cleaned.



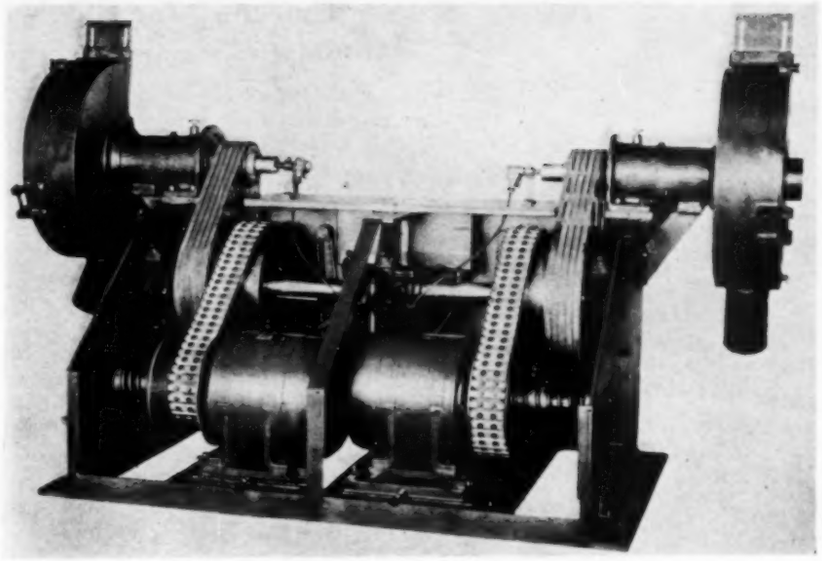
The apron has an oil reservoir in the bottom which holds from 1 to 2 gal. of oil, depending on the size. A pressure pump, automatically driven by the apron handwheel, supplies oil under pressure to every part of the carriage as it bears on the bed and to the compound rest bottom slide bearings of the carriage. The amount of oil is metered to each point. A reservoir in the top of the apron is automatically filled and supplies oil through tubes to all the roller bearings in the apron. The large diameter apron gears dip in the oil of the reservoir and carry it to the entire gear train.

The headstock is oiled by the splash system and requires attention once a year. Filtered oil is supplied automatically to the Timken spindle bearings. The quick-change gear box is oiled from central reservoirs which are filled once a week. The driving pulley is oiled once a year. Thus, each lubrication requirement is appropriately met.

"Production" Variable-Speed Grinders and Buffers

Variable spindle speeds to suit requirements for grinding, buffing and polishing may be secured on a two-spindle floorstand machine developed by the Production Equipment Company, 5219 Windsor Avenue, Cleveland, Ohio. This spindle speed control is made possible by use of Reeves variable-speed pulleys, which are adjustable by handwheels located near the operator's station. The rear view illustrated shows the protecting frame removed so that the two motors with variable-speed pulleys attached and V-belt drives may be seen.

When the speed of the spindle is infinitely controllable the wheel can be maintained at the same peripheral speed and proper grinding action assured during the life of the wheel. A chart giving the spindle r.p.m. is mounted at the wheel guard. Five columns of figures are



given to indicate peripheral speeds of 7,500, 8,000, 8,500, 9,000 or 9,500 surface feet per minute with wheel diameters of 13 in. to 24 in. inclusive. Movement of the plate to a position where it clears the grinding wheel by approximately ¼ in. enables the operator to read the spindle speed necessary in order to obtain the predetermined peripheral speed.

Connected to one end of the spindle is a tachometer. The connecting shaft runs from the spindle to the indicating head located at the front of the machine and directly under the motor controlling button. Speed of the grinding wheel is adjusted by moving the handwheel located in the front of the machine until the tachometer head indicates the desired r.p.m. The grinder is built in a combination of welded construction with half spindle housings.

Champion General-Purpose Welding Rods

General-purpose welding rods are being placed on the market by the Champion Rivet Co., Cleveland, Ohio, in order to give a complete metal joining service. The company will continue to market its rivets.

G&L No. 0 Motor-Driven Surface Grinder

For very fine, delicate, accurate surface grinding, the Gallmeyer & Livingston Co., Grand Rapids, Mich., has announced the No. 0 motor-driven surface grinder, which is available in the column-type as illustrated, or can be furnished in the bench type. In addition a portable-type column can be supplied

to those who have occasion to move a machine of this kind from one department to another.

The column provides dovetailed ways for raising and lowering the knee. On its upper surface, the saddle is 16 in. long. Saddle bearings are protected from dirt and grit. The table is 5 x 29 in. over-all with a 5x12-in. working surface. Two T-slots are arranged for carrying a magnetic chuck. End guards are cast solid with the table to insure maximum protection for the longitudinal ways. Table travel of 12 in. is provided by rack and spiral pinion, and is actuated by a handwheel. The 5½-in. cross feed is provided by an Acme thread screw. As standard equipment, a 6x½-in. grinding wheel is supplied. A ½-hp. motor is standard equipment.

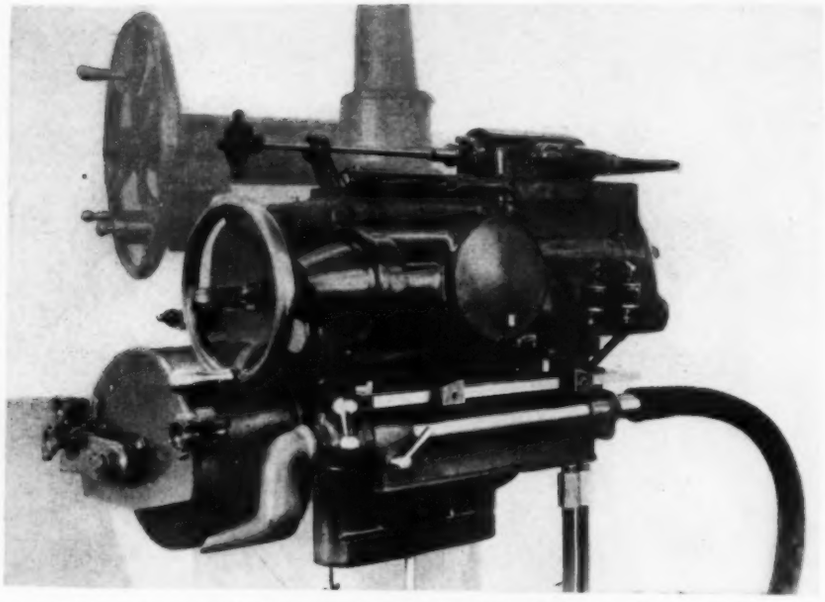
Prest-O-Weld No. 5 Welding-Cylinder Truck

The Linde Air Products Co., 30 E. 42nd St., New York, N. Y., has introduced a cylinder truck for use by welders in shops where portable oxy-acetylene welding and cutting equipment is employed. The frame of the No. 5 truck is made of 1¼-in. angle iron welded into a rigid unit. A beveled steel plate forms the cylinder platform. Cylinders are held firmly in position on the truck by means of chains which are adjustable. Easy handling of the truck is facilitated by the 12-in. cast-iron wheels with 2-in. tires. Overall size of the truck is 48 in. high by 30 in. wide, and the weight is 80 lb.

Automatic Cross Feed for Norton 10x12-In. Surface Grinders

A hydraulically operated automatic cross feed or wheel traversing mechanism is now offered by the Norton Co., Worcester, Mass., for use on its 10x12-in. surface grinders. Maximum efficiency from the grinding wheel is obtained since the wheel can be fed across the work at each reversal by increments that utilize the full width of the standard 1½-in. wheel. Otherwise, the greatest feed possible is only a small fraction of the total wheel width. Elimination of the manual cross feeding operation gives the operator time for gaging work or running another machine.

The mechanism is adjustable and provides any feed from $\frac{1}{8}$ in. up to 1½ in., and direction of wheel traverse is automatically reversed by the use of dogs,



Automatic cross feed applied to Norton 10 x 12-in. Surface Grinder

which can be set to accommodate any width of work up to 10 in. Oil is drawn from the same reservoir and by the same pump that supplies the table traverse mechanism, and an adjustable metering device in the apron controls the amount of feed. From the metering device the oil is delivered through a telescoping pipe to a traverse reverse valve mounted on the vertical slide. From this valve the oil is conducted through ports to a cylinder on the underside of the vertical slide. In the cylinder is a double-rodded piston (for equalizing the displacement) connected to the wheel side. Wheel truing is accomplished by manual operation of the traverse valve, and the same control is used for disengaging the power cross feed. The hand-feed is automatically disconnected when power cross feeding.

"Unicams" for B & S Automatic Screw Machines

If a large number of Brown & Sharpe lead cams are cut into separate lobes it will be found that the same lobes recur many times. This has been recognized by the Fischer Special Mfg. Co., Cincinnati, Ohio, which is now producing separate cam lobes of standard lengths and rises. By assembling these individual lobes on a spool, a lead cam of the required number of lobes can be built up which will do the work of a solid cam. To use this built-up cam, a lead cam lever with a wide roller and several other parts are substituted for the ones on the machine, after which either "Unicams" or solid cams can be used. It is claimed that where Unicams are adopted instead of solid cams, savings can be made not only in the cost of cams but also in the time saved by being able to get Unicams from stock. The user soon accumulates a number of lobes, many of which can be used on subsequent jobs, so that after a while the lobes accumulated will be sufficient for any new jobs as they arise. This facilitates production of small quantities of parts of constantly changing design.

Unicams are made in 3½, 4, 4½, 5, 6, 7 and 9 in. diameters, and thicknesses of $\frac{3}{16}$ and ¼ in. to fit the No. 00, No. 0 and No. 2 Brown & Sharpe automatics. They are interchangeable between the three

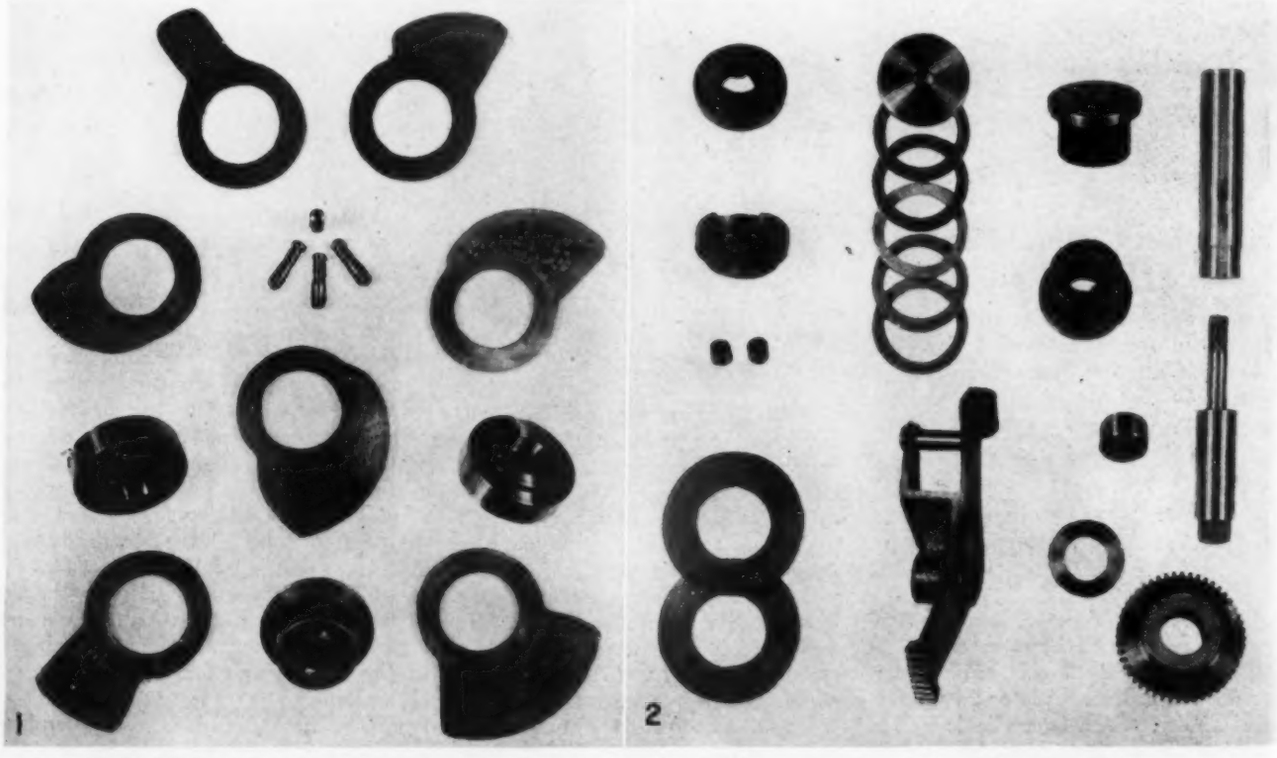


Fig. 1—Holes in cam lobes and spools are broached with 100 teeth for convenient adjustment around the cam circle.
Fig. 2—Extra parts required for Brown & Sharpe No. 00 Automatic Screw Machine

machines, and between the cross-slide and lead cam spools. Different lobes are made with rises and falls for fast and slow machines times, and all lobes are hardened and marked so they can be readily identified. Any number or lobes up to six can be built up. The cams are made with standard rises up to 3 in. in height, with a variation between rises of 0.020 in. The reason for using 0.020 steps in the rises is that this variation allows some clearance on nearly all fractional sizes. The lengths in hundredths are in multiples of 3 up to 15, and in multiples of 5 from there to 80. The hole in the Unicams is broached with 100 teeth and the spool has the same number of teeth, so that the lobes are adjustable around the cam circle by single hundredths. Indexing space for different machine times can thus be varied by single hundredths.

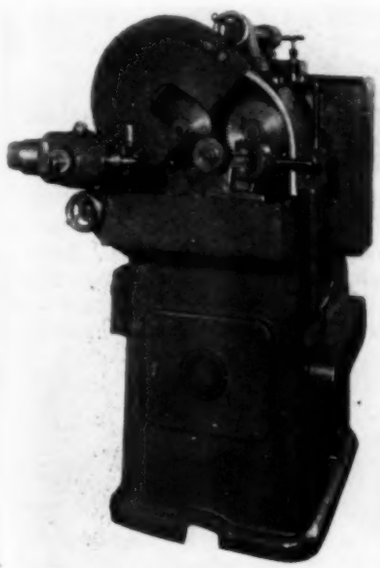
Fellows Gear Lapping Machine

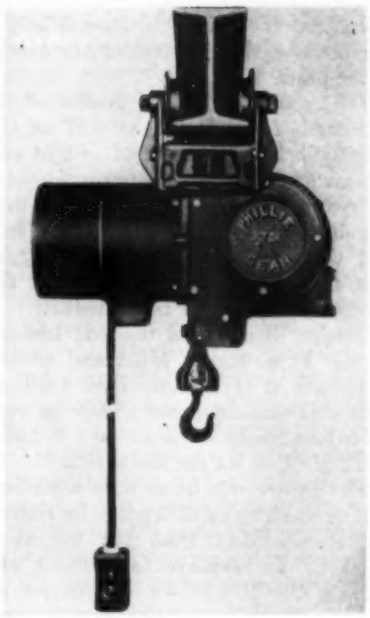
The Fellows Gear Shaper Co., Springfield, Vt., has developed a new method of finishing gears by lapping after hardening. This process, in addition to smoothing the contacting profiles of the teeth, also removes slight distortions resulting, from heat-treatment. The machine will lap spur, helical and herringbone gears. It operates on a high production basis.

The principle of operation is known as the "3-Lap Recess Type," which affords rotation of the work and laps and reciprocation of the work at a fairly high rate of speed. This effects adequate distribution of the lapping compound over the contacting teeth. The work spindle is positively driven through change gears, and the three laps are rotated by the action of the work. Independent and adjustable friction brakes are applied to each of the three lap spindles so that the pressure can be varied. Drive for the reciprocating motion and drive for the rotary motion of the work are independent, so that the rotative speed and number of strokes can be varied to suit the number of teeth in the gear. The length of stroke can also be varied.

In order to change the pitch line contact of the three laps on the work, each of the laps can be made with a different number of teeth. Center distances of the work-spindle and the three lap spindles are not adjustable, but through the medium of an independent mechanism the two upper lap spindles, which are mounted on self-aligning ball bearings, can be set at a slight angle with relation to the axis of the work. This feature makes possible the correction of slight errors in the axial relationship of the teeth, which results from distortion in heat-treatment, and is especially advantageous in lapping helical gears. The amount of offset or misalignment of the two upper spindles is indicated by means of dial indicators reading to 0.0001 in.

Operation of the machine is entirely automatic. The limit switch can be set to any one of eight predetermined numbers of revolutions for the work in both directions. Upon completion of the number of revolutions desired, the machine stops automatically. A 2-hp., 1,200 r.p.m. motor drives the machine through a single pulley, and operates both the rotative and reciprocating mechanisms, and also the lubricating pump and electric limit switch. A ½-hp. 1,800 r.p.m. motor, mounted in the opposite side of the base drives the coolant pump. This pump is provided with an agitator to keep the compound mixed when the machine is in operation.





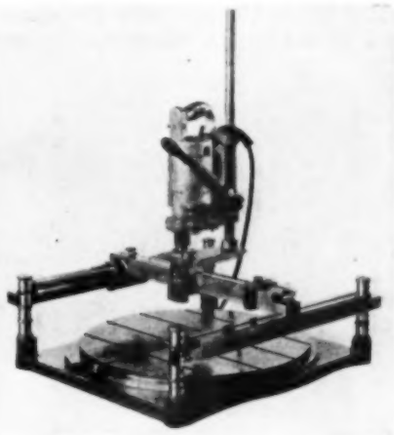
The hoist is pushbutton controlled. Hook swivels are ball-bearing equipped. Cable drums are of large diameter with machined grooves. Nickel-bronze worm gears, hardened-steel trolley wheels with ball bearings, nickel-steel heat-treated helical gears and hardened and ground thread worms, automatic upper-limit hook stop, forged steel hooks and oil-bath lubrication are among other features.

Philadelphia Electric Hoists

The Philadelphia Gear Works, Philadelphia, Pa., has added to its line an electric hoist built in sizes from ¼ to 3 tons. The hoist has the following features: High lift with low headroom; noiseless operation; no load brake necessary; balanced so that load is always under exact center of rail; hoist swivel trolleys turn on 4-ft. radius; fine control of load; operating mechanism sealed against oil and dirt; heavy-duty construction and interchangeability of parts. Standard electric motors are used and Timken roller bearings are employed.

Reed-Prentice Combination Drilling and Layout Fixture

A universal fixture for laying out work as well as drilling holes up to ½ in. is being placed on the market by the Reed-Prentice Corp., Worcester, Mass. This fixture is made in two sizes only, one with a 12-in. rotary table, and the other with a 20-in. rotary table. Standard height under the crossbar on the 12-in. size is 10 in., and standard height on the



20-in. size is 12 in. Additional height can be secured by increasing the height of the posts.

The rotary table is graduated in minutes. The crossbar as well as the longitudinal bar is arranged so that end measures with micrometers can be used for spacing in either direction. The drill is guided for either spotting or drilling, and the attachment can be swung so that the drill can be used either on the back or the front of the crossbar.

Outside diameter of the drill bushing on the 12-in. size is 1 in., and on the 20-in. size it is 1¼ in. Drill bushings with this outside diameter can be used up to a capacity of ⅜ in. on the 12-in. size and ⅝ in. on the 20-in. size.

The fixture can be used in a vertical milling machine or drill press, by removing electric drill from the top cross bracket. In addition to spotting and drilling, the attachment is arranged so that milling of templets can be performed, using the circular table for the radius sections as well as the angular section. Straight milling can be done by moving the crossbar or longitudinal bar.

Murchey Type "R-C" Self-Opening Diehead

A line of self-opening dieheads designed for use on any machine in which the diehead is revolved is being introduced by the Murchey Machine & Tool Co., Detroit, Mich. This Type "R-C" rotating diehead is made in sizes from ⅝ to 1¼ in., inclusive. It is equipped with circular chasers that are ground in the thread. The dieheads and chasers are offered for production work.

The diehead is opened and closed automatically by means of a collar trip, which insures positive opening and accurate thread lengths. These features make the tool suitable for use in multiple-spindle automatic screw machines and second-operation machines. Each chaser is fitted to a splined locating post, which passes through both the chaser and its holder. A wormwheel is machined on the lower end of the locating post. Each holder is equipped with two worms which apply direct counterforces to the cutting edge of the chaser through the wormwheel. Adjustments to 0.001 in. are available through the worms. The locknut on top of the chaser assures rigidity. The graduated adjustment is a feature in regrinding chasers, since it eliminates the necessity of grinding off more than the worn portion of the chaser. It is also possible to adjust (without regrinding) the chasers exactly to the desired cutting point. A single chaser may be replaced without disturbing the remaining ones.

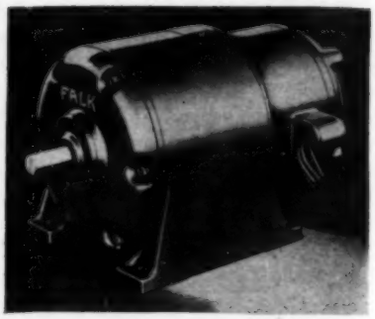
The four chaser holders may be removed with the fingers, and the chasers ground without taking them from the holders. Each chaser holder is actuated by two springs located in the body directly in line with the point at which the load is imposed by the chaser.

Jacobs Single-Purpose Chuck

Designed for use on high-production machines where multiple spindles on close center distances require a chuck with minimum diameter but with maximum gripping power, a single-purpose chuck has been announced by the Jacobs Mfg. Co., Hartford, Conn. The taper thread provides gripping power, but also offers rapid and positive release. End adjustment of the tool is permitted and no change in the adjustment takes place in the tightening operation. Although Morse taper shanks are standard, straight or special tapered or threaded applications can be provided for use on screw machines, turret lathes or other machines.

Falk Motoreducers

Three styles of motoreducers (combined motor and speed reducer) have been placed on the market by the Falk Corp., Milwaukee, Wis. The gear housing in every case acts as a support for the motor. In the integral type, the motor end bell is removed. In the all-motor type, any standard horizontal-type motor may be employed, the motor being connected through a Falk flexible coupling to the reducer housing. In the flexible type, the round-frame type motor is used and the end bell is retained.



Falk Integral-Type Motoreducer, in which the motor end bell has been removed and the motor frame close-coupled to the gear housing

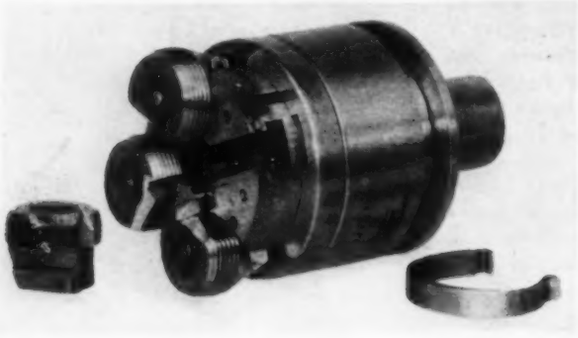
All three types are supplied in horsepowers from ¾ to 75, and in ratios from 4.6 to 288. Non-planetary, helical-type gears are used throughout. Bearings are oversize. Efficiency is 97 per cent.

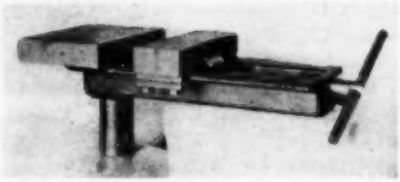
Garlock "Thiokol" Packings

The Garlock Packing Co., Palmyra, N. Y., has announced the development of a number of packing items such as diaphragms, disks, and gaskets, made of various "Thiokol" compounds. This material has most of the characteristics of rubber, but is not affected by solvents and does not oxidize. Because of these properties it is fitted for use in packings, where rubber coming in contact with solvents would quickly disintegrate. The packings are offered for use in place of rubber where liquids to be conveyed are gasoline, ether, kerosene, carbon tetrachloride and also gases.

"Modern" Combination Drill Table and Vise

An all-steel combination drill table and vise has been announced by the Modern Machine Tool Co., Jackson, Mich. It is a smaller size than manufactured previously, and is designed primarily for the smaller shop. Constructed





of plates and angles, welded and machined, the tool is available in three sizes, with 6, 7 and 8-in. square tables that open from 4 to 4½ in. All vises are 1 in. deep.

Philadelphia Motoreducers

Philadelphia Gear Works, Erie Ave. at G St., Philadelphia, Pa., has announced a horizontal "MotoReduceR" in which all working parts are easily accessible and in which misalignment of the parts is said to be unlikely to occur. The motor and gear apparatus are contained in a single housing with supporting feet at each end of the frame. Therefore, there is no overhang of the gear or motor. The close-coupled unit eliminates

a flexible coupling and baseplate. Gears are made from heat-treated nickel steel with helical cut teeth, and they run in an oil bath. All bearings are of the anti-friction type. The slow-speed shaft is mounted on oversize Timken roller bearings spaced to permit overhanging a pinion, sprocket or pulley without the use of an outboard bearing support.

The MotoReduceR is available in single, double and triple types with ratios up to 450 to 1, and is furnished with standard open type or totally inclosed fan-cooled motors, polyphase and single phase. It is also available with d.c. motors up to 10 hp.

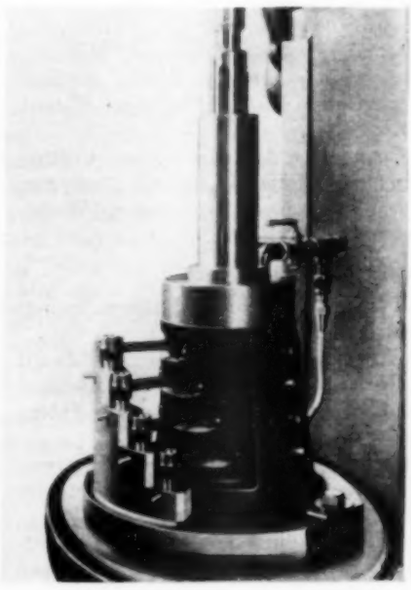
Micromatic Honing Fixture and Automatic Hone

Heretofore it has only been possible to hone cylinder bores or tubes where the length exceeded the diameter. Therefore, there has been a need for means to produce greater accuracy and better finish on various size holes within the classification of rings or shallow open-end holes. This field includes a large variety of parts produced in sufficiently large quantities to warrant the initial expenditure for high production equipment. Outstanding examples are crankpin holes in connecting rods for small internal combustion engines and various roller bearing races.

The new type steel-back replaceable bearing is now extensively being considered for use in connecting rods for automobiles. Inasmuch as the bearings necessarily have a very thin cross section, the accuracy after installation is only as good as the hole in the rod. Therefore, a motor car manufacturer has installed equipment made by the Micromatic Hone Corp., Dubois St. at Horton Ave., Detroit, Mich., for the purpose of honing the connecting rods of its V-type eight cylinder engine. The requirement for accuracy in this case was within a tolerance of 0.0003 in., together with a high degree of finish. The equipment consisted of a honing fixture in connection with a new Model 1A-Z-S three-finger, full-automatic hone.

While the features of construction and operation of this tool and fixture are new, the basic principles of honing are maintained, it is said. The difference in the case of this development is that the work is floated while the tool is piloted and at the same time a number of pieces are honed simulaneously. Attempts to hone several pieces at one time have been unsuccessful previously, because it has been impossible to clamp the parts together without the effect of accumulated error. It is also difficult to clamp small parts sufficiently tight without excessive distortion when attempting to maintain limits for accuracy below 0.0005 in. The method employed in this fixture allows each piece of work to float independent of one another so that there is no effect from accumulated error given by previous machining operations. The pieces are centered and held in alignment on resilient wiper guides which are mounted in the body of the honing tool in such a manner as to obviate the necessity for clamping or locking. The honing stones are floating in relation to the body of the tool and the work to compensate for any uneven stone wear and prevent the abrasive sticks from disturbing the alignment provided by the wiper guides. The resilient guides extend beyond the abrasive members to keep two or more connecting rods in alignment at one time. The tool automatically centers the parts from the hole to be honed without regard to any other locating points. This feature makes rechucking possible.

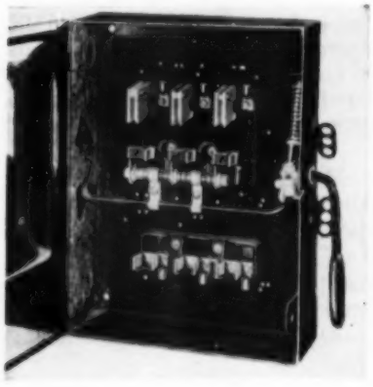
With a fixture to hold four pieces to be honed simultaneously, time studies made under average conditions revealed that 0.0007 to 0.0012 stock may be removed from a ground hole in an actual honing period of 25 seconds, with a floor-to-floor time of forty seconds. About 500 rods are honed with one set of stones.



Square D Type C Industrial Switches

An improved line of Type C industrial switches has been announced by the Square D Co., Detroit, Mich. Among the major improvements are larger boxes, positive quick-make and quick-break operating mechanism and the addition of positive-pressure fuse clips. These features make the Type C switches equivalent to the Type A switches, with the exception of keyed interlocking. Capacities range from 30 to 600 amp., 250 volts, and 30 to 200 amp., 575 volts, fused or unfused.

The company also has announced a general-service line of switches ranging in capacity from 30 to 400 amp., 250 to 575 volts, fused or unfused. Switches



rated above 30 amp. are quick-break only.

Bulletin CA-202 describing these two lines is available.

• PATENTS •

AUGUST 30, 1932

Metal-Working Machinery

Indexing Attachment for Automatic Machines. Martin E. Anderson, Waterbury, Conn., assigned to The Bristol Co. Patent 1,874,022.

Metal Cutting Tool. Charles B. Gray, Millbourne, Pa. Patent 1,874,036.

Cutting Machine. Charles B. Gray, Millbourne, Pa. Patent 1,874,038.

Forging Machine. Alonzo Linton Bausman, Springfield, and Edward D. Rapisarda, Agawam, Mass., assigned to National Equipment Co. Patent 1,874,158.

Rotary Milling Machine. Joseph B. Armitage, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,874,218.

Hydraulic Table Drive for Milling Machines and the Like. John P. Ferris, Milwaukee, Wis., assigned to the Oilgear Co. Patent 1.874,265.

Hydraulic Feed for Lathes and the Like. Walter Ferris, Milwaukee, Wis., assigned to the Oilgear Co. Patent 1,874,266.

Feed Mechanism for Milling Machines. Walter Ferris, Milwaukee, Wis., assigned to the Oilgear Co. Patent 1,874,267.

Machine Tool. Edward J. Kearney, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,874,305.

Grinding Machine. Hans Fritschi, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,874,491.

Grinding Machinery. Lester F. Nenninger, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,874,583.

Hob Grinding Machine. Carl G. Olson, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,874,592.

Hob Grinding Machine. Joseph R. Richer, Oak Park, Ill. Patent 1,874,626.

Electrically Controlled Milling Machine for Metal. Leon Saives, Billancourt, France, assigned to Louis Renault, Billancourt, France. Patent 1,874,810.

Milling Machinery. Walter D. Archea, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,874,846.

Broaching Machine. Francis J. La Pointe, Ann Arbor, Mich. Patent 1,875,033.

Cutter Grinder. Willy Scharff, Frankfort-on-the-Main, Germany. Patent 1,875,163.

Tools and Attachments

Chuck or Holding Device. Albert E. Church, New Britain, Conn., assigned to the Union Manufacturing Co. Patent 1,874,082.

Apparatus for Truing Grinding Wheels. Thomas Barish, Jamestown, N. Y. Patent 1,874,156.

Screw Driver and Wrench Friction Drive. Alonzo G. Decker, Baltimore County, Md., assigned to the Black & Decker Manufacturing Co. Patent 1,874,250.

Grinding Device. Allan H. Jones, Trenton, N. J. Patent 1,874,301.

Extrusion Die. George W. Greenwood, Wilmington, Del., assigned to Stephen F. Whitman & Son, Inc. Patent 1,874,503.

Locking Means for Workholders or Jigs. Edward L. Greer, Highland Park, and Karl F. Marx, Dearborn, Mich. Patent 1,874,504.

Screw Thread Gaging. James Hartness, Springfield, Vt. Patent 1,874,517.

Method of Making Milling Cutters. Charles J. Irwin, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,874,536.

Cutter and Cutter Holder for Taps. Samuel F. Newman, Waynesboro, Pa., assigned to Landis Machine Co. Patent 1,874,586.

Die Head. Harry T. Shearer and Charles A. Reimschissel, Waynesboro, Pa., assigned to Landis Machine Co. Patent 1,874,643.

Abrasive Mounting for Grinding Devices. Philo D. Bates and Marsden Cleckley Hutto, Detroit, Mich., assigned to Hutto Engineering Co., Inc. Patent 1,874,855.

SEPTEMBER 6, 1932

Metal-Working Machinery

Grinding Machine (Cutter). Carl J. Anderson, Chicago, Ill., assigned to Erik Borg and Carl U. Johanson. Patent 1,875,547.

Metal Working Machine (Milling). Henry Krebs, Detroit, Mich., assigned to Packard Motor Car Co. Patent 1,876,248.

Completely Automatic Gear Cutting Machine. Herbert J. White, Rochester, N. Y., assigned to Gleason Works. Patent 1,876,372.

Tools and Attachments

Thread Gage. James Hartness, Springfield, Vt. Patent 1,875,726.

Attachment Spindle Clamp. Edward J. Kearney, Wauwatosa, Wis., assigned to Kearney & Trecker Corp. Patent 1,875,739.

Screw Thread Gage. Robert Thomson, Newark, N. J., assigned to Dardelet Threadlock Corp. Patent 1,875,899.

Chuck. William L. Trumphour, Cleveland, and Max E. Lange, Cleveland Heights, Ohio, assigned to the Warner & Swasey Co. Patent 1,875,959.

Adjustable Lock Tool Holder. Ralph R. Weddell, Shelton, Conn., assigned to The O. K. Tool Co., Inc. Patent 1,875,967.

Apparatus for Automatic Expulsion of Worked Articles from Stamping Power Presses. Donato Zazzara, Naples, Italy. Patent 1,876,161.

Compensating Mechanism for Machine Tools. Henry Sidgreaves, Pawtucket, R. I., assigned to Brown & Sharpe Manufacturing Co. Patent 1,876,352.

Machine Tool Compensating Mechanism. Henry Sidgreaves, Pawtucket, R. I., assigned to Brown & Sharpe Manufacturing Co. Patent 1,876,353.

SEPTEMBER 13, 1932

Metal-Working Machinery

Grinding or Cutting Machine. Phillip J. Fobert and Adrien J. Ducharme, Detroit, Mich., assigned to Detroit Aluminum & Brass Co. Patent 1,876,899.

Vertical Continuous Drilling Machine. Frank M. Davis, Milwaukee, Wis. Patent 1,877,277.

Hydraulic Grinder. Sol Einstein, Cincinnati, and Herman R. Isler, Norwood, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,877,500.

Grinding Machine. Frederick S. Haas and Bernard A. Kearns, Cincinnati, Ohio, assigned to the Cincinnati Grinders Incorporated. Patent 1,877,505.

Grinding Machine. Carl G. Liljeberg, Pittsburgh, Pa., assigned to Cincinnati Grinders Incorporated. Patent 1,877,515.

Grinding Machine. Hugh M. Albee, Orange, Mass., assigned to the Leavitt Machine Co. Patent 1,877,546.

Vertical Continuous Milling Machine. Frank M. Davis, Milwaukee, Wis. Patent 1,877,560.

Grinding Machinery. Robert E. W. Harrison, Frederick S. Haas, and George W. Binns, Cincinnati, Ohio, assigned to the Heald Machine Co. Patent 1,877,572.

Automatic Screw Machine. Charles A. Rich, Providence, R. I., assigned to Brown & Sharpe Manufacturing Co. Patent 1,877,693.

Tools and Attachments

Operating Means for Power Presses. William G. Humphrey, Wheeling, W. Va. Patent 1,876,944.

Grinding Mechanism. Frank J. Jeschke, Detroit, Mich., assigned to James J. Young. Patent 1,877,328.

Processes

Method of Cutting Gears. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works. Patent 1,877,173.

Method and Apparatus for Relieving Hobs. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works. Patent 1,877,174.